FILE X3.2

PROGRAMMING STANDARDS and DOCUMENTATION SUBCOMMITTEE

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ERIC H. CLAMONS

IBM's Plans to Implement ASCII on the System/360
C. E. Mackenzie
16/October/64

Good morning, ladies and gentlemen. It is a pleasure and an honor to have been invited to address this session of GUIDE. Mr. John Booth of Teletype Corporation has just covered in his usual able fashion the current status of ASCII and the various media today. My part of the session deals with IBM's plans for implementing ASCII on the System/360.

The first point I wish to make is that IBM supports and participates in the development of industry and national standards. Members from IBM participate in all the subcommittees mentioned in John Booth's presentation: X3.1, OCR; X3.2, Codes and Media; X3.3, Data Communications; X3.4, Programming; X3.5, Glossary; X3.6, Problem Definition; X3.7, MICR. Additionally, in Europe, IBM is represented on equivalent task groups of ECMA, the European Computer Manufacturer's Association. IBM is also active in various other standardization groups in countries around the world.

The second point that I wish to make is that there may be a considerable difference between supporting the development of an industry standard and supporting the standard itself. By supporting the standard, I mean implementing the standard in hardware or software. As a manufacturer, IBM feels that its primary function is to supply equipment to meet the needs of the market place. With respect to

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supporting each and any industry or national standard, with either hardware or software, IBM will always make a businesslike decision. One of the important factors in such a decision will always be a determination of customer needs. The Questionnaire which has been distributed to all members of GUIDE at this meeting (and which was previously distributed to members of SHARE) is one of the tools used to determine customer needs in the area of information interchange.

The third point that I wish to make is that, to meet clearly established customer needs, IBM will continue to provide the BCD code on magnetic tape, on punched cards, on perforated tape, and for data communications. Perhaps a word of explanation would be helpful with respect to BCD. BCD as a 64 character set, or as a 6-bit code, has been provided on the 1400 family, on the 7070 family, on the 7080 family, on the 7090 family and on the 7040 family. The Extended BCD Interchange Code, which is a 256 character, 8-bit code is being provided on the System/360. The Extended BCD Interchange Code is indeed an extension of the BCD Interchange Code, and matches from a card code point of view and from a magnetic tape code point of view, the letters of the alphabet, the digits, and eleven of the most widely used special graphics. The card codes assigned to some of the other graphics are different between the BCD Interchange Code and the Extended BCD Interchange Code but these changes should not provide any serious problems for IBM customers. Incidentally, a card code chart was shown in the Principles of Operation Manual for the

System/360. Since that Manual was issued, some changes have been made in the assignment of graphics. It is of interest to note that most of these changes have been made in order to assure graphic consistency with the graphics of ASCII. A Technical Newsletter has just been issued to the field and shows the approved code charts for the Extended BCD Interchange Code (Form No. N22-0155). This code chart shows graphics, controls, 8-bit patterns, and the card codes for all 256 characters of the Extended BCD Interchange Code. It may also be of interest to you to know that on the 12th of October, 1964, IBM announced a new keypunch and verifier (029 and 059) which can keypunch and interpret 62 graphics. The card codes punched agree with those shown in Form N22-0155.

The fourth point that I wish to make is that IBM has been unable to determine any appreciable customer needs for ASCII on magnetic tape, or on punched cards, or on perforated tape as input/output for a computer. Of course, IBM will obtain and review any new information on customer needs for ASCII on a continuing basis.

A word about the ASCII punched card code. As we stand today, there is no such punched card code as an American Standard. There is a punched card code under development by X3.2.3. X3.2.3 has looked at four different coding concepts for punched card codes. The first coding concept was the Direct Binary using rows 1 - 7 of the card, and punching a hole where a bit occurs in the code. The second coding concept that was looked at was called Decimal ASCII. It has some of the features of the BCD Interchange Code and some of the features of easy translation to ASCII. At a recent meeting of X3.2.3 it was voted to postpone further work on Decimal ASCII until an area of application could be defined. Most recently X3.2.3 has begun development of an Extended Hollerith card code. This may turn out to be very similar, perhaps identical with, IBM's Extended BCD Interchange Code. Also, very recently X3.2.3 has begun to look at what is called the Edge-Punched Card. The Edge-Punched Card punches the perforated tape code on a strip either along the top or along the bottom of a punched card.

A word about magnetic tape. There is in existence a proposed American Standard Recorded Magnetic Tape. It is interesting to note the agreements and disagreements of this proposed standard with the specifications of the IBM Series 2400. The agreement is necessarily on a physical basis, since the code to be used on that proposed standard is ASCII. Agreements are as follows; 1/2" interrecord gap, NRZI recording, 1/2" width, 9 tracks, track width and spacing. The disagreements are on code and on the density. The density of the proposed standard is 200 bits per inch, and the density of the Series 2400 is 800 bits per inch. The question has been asked, if a proposed recorded magnetic tape standard is developed at 800 bits per inch, would the System/360 be able to handle it? The answer is yes, the Series 2400 is code insensitive. No translation takes place between the magnetic tape and the CPU. It is clear that since the tape could be read and written, programmed translation could be used to handle ASCII magnetic tape written at 800 bpi.

The fifth point that I wish to make has to do with data communications. A need probably will develop for ASCII on data communications, and associated perforated tape equipment. However, it should be pointed out that to have the standard code agreed on for data communications is a very small part of the entire picture. Much industry standardization effort for data communications involving ASCII is not yet beyond the study or development phase. Specifically, development of standards is proceeding with the following aspects of data communications; character structures, speed, line control, and error recovery. Until these standards are developed and approved, or at least have reached some degree of firmness, it is not feasible at this point in time to make definite plans for data communications involving ASCII.

Thank you, ladies and gentlemen. In closing, let me say once again, that it has been a pleasure to come and talk to you.

Whitpain

E. H. Clamons

R. W. Bemer

New York, October 19, 1964

Director-Systems Programming

DRAFT REVISION OF ASCII

X3.2.4/64
64 OCT 20

The following constitute my comments on the September 23rd draft:

1) In the code chart the column and row number should be marked for reference only, because of sub- and supersets. In 3., column and row numbers are said to come from binary notation. Surely this is hexadecimal.

2) In the chart, and as mentioned in 4.2, 5.3, A6.2 and C2.14 S.P. (space) is erroneous. Definition D-11 of the IFIP terminology defines space as: "one or more consecutive blanks". Blank (D-10) is the proper term.

3) On page 11 the definition of CNCL (cancel) is poor. How far does the effect of the character extend, in which direction, or both, and how is it limited?

4) In A6.1, comparison alone will not result in ordering.

5) In A6.9, tenth line, insert "simple passive transformation".

6) In reference to the chart and A6.3, I still have problems with the underline, circumflex and opening quotation mark. What, for example, is the collating precedence between N̂ and C̀? It seems to me that the backspace code is the critical operator (rather like a junior escape) and the codes can, therefore, have an alternative graphic as before when the backspace is not present. It is certainly conceivable that a typing device could discriminate well enough to check to see if the back space had been received just prior to this code. Note 8 to the ISO 7-bit table certainly allows this, particularly as explanatory note 2 says that this symbol takes on diacritical significance only when following the backspace.

7) In A6.3, the boys didn't read the ISO document very well. It is the tilde used in Spanish or Portuguese, not the circumflex as given in note 7. Swap places. Therefore section 3, third draft, note 7, has it correctly.

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8) Under 4.2 where do they get off with the overline as being consistent with negation?

9) In 5.1.3, I think the left arrow does have utility and is extremely important for programming to replace the : = of ALGOL. I maintain that the left arrow should be acceptable if not preceded by a backspace.

R. W.,Bemer

jc

X3.2/165
October 30, 1964

Appendix J

Report of Meeting No. 15, ASA Task Group X3.2.4
Code Assignments
October 19, 20, and 21, 1964
BEMA Headquarters, New York City

1. Attendance

Members and Attendees	Affiliation	Status	October		
			19	20	21
J.L. Little - Chairman	National Bureau of Stand.	M	X	X	X
J.F. Auwaerter	Teletype Corp.	M			
E.A. Avakian	Bunker-Ramo Corp.	M	X		X
J.B. Booth	Teletype Corp.	A	X		X
E.H. Clamons	Univac	A			
C.J. Davis	IBM	M		X	X
R.J. Donahue	Mergenthaler Linotype	M	X	X	X
W.F. Emmons	IBM	A	X	X	X
R.F. Ewald	BTL	A			
E.S. Fergusson	Rockford Research Insti.	O	X	X	X
J.G. Griffis	DCA	M	X	X	X
R.M. Gryb	AT&T	M			
W.F. Huf	Navy	M			
J.D. Keen	Univac Div.	M			
D.A. Kerr	Bell Telephone Labs	A	X	X	X
W.Y. Lang	BTL	M			
E.J. Lewis	ITT - DISD	M			
B.V. Magee	USAEL Ft. Monmouth	M			
J.K. Nelson	Western Union	M	X		
F.W. Smith	Western Union	A		X	
H. Spielman	RCA	M			
H. Tholstrup	Friden	M			
L.R. Turner	NASA	M		X	X
H.C. Umstead	USAELRDL	A			
E.F. Vidro, Jr.	Xerox Corp.	M	X	X	X

M = Member   A = Alternate   O = Observer

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2. Membership Status

The Task Group reaffirmed its previous acceptance of R.J. Donahue as a member.

3. Corrections to Previous Minutes

a. A.E. Avakian is affiliated with Bunker-Ramo Corporation.
b. E.S. Fergusson was mispelled. There should be two s'.

4. Documents Distributed to X3.2.4/

53 - Second Draft of Proposed Appendices for the Proposed Revision of ASCII. D.A. Kerr, dated October 7, 1964.

54 - Use of Currency Symbols, D.A. Kerr to Members ASA X3.2.4, dated October 9, 1964.

55 - Excerpt relating to Diacritical Marks from Webster's New International Dictionary, Second Edition, unabridged, E.H. Clamons to X3.2.4, dated October 6, 1964.

56 - ISO/TC97/SC2 (Secr. 32)125 F/E Draft Proposal; X3.2/161; sent to X3.2 and Task Groups by E.H. Clamons, dated October 12, 1964.

57 - Related Sets, E.H. Clamons to X3.2.4, dated October 14, 1964.

58 - Draft Expository Remarks to ASCII Revision, J.L. Little to Members X3.2.4, dated October 16, 1964.

59 - Suggested Improvements to Appendices Draft, W.F. Emmons to Chairman Ad Hoc Committee on Draft Revision X3.9-1963 Appendices Draft, dated October 12, 1964.

60 - Suggested Improvement to Draft Expository Remarks, W.F. Emmons to Chairman X3.2.4 Ad Hoc Committee on Draft of ASCII Expository Remarks, dated October 12, 1964.

61 - Coded Set for Army Chemical Typewriter, dated October 14, 1964.

62 - Tentative 7-Bit Code CCITT Version, dated October 9, 1964.

63 - Application of the New Telegraph Alphabet in Japan, Temporary Document No. 3-E, CCITT Joint Working Party "New Alphabet", dated October 6, 1964.

4. CCITT Report - Geneva Meeting

J.K. Nelson reported on the Geneva meeting and passed out a tentative CCITT Code Table. This code table dated October 9, 1964, although unoffical, does give advance knowledge as to their thoughts on the ISO & proposed revised ASCII code tables. Russia has entered the picture on code standardization and the following changes reflect their thoughts:

a. _(Underline) position 4/0 was changed to `(Grave accent).

b. `(Grave accent) position 5/15 was changed to _(Underline).

c. Currency Symbol (CS) position 2/4 was changed to a general currency symbol ¤.

d. ~replaces \ in position 5/12.

The CCITT code table is included as an attachment for information purposes only. The task group decided to take no action, at this time, on CCITT proposal regarding the proposed revised ASCII.

5. Second Currency Symbol ISO and Revised ASCII Code Tables

The question of a second currency symbol for the revised ASCII code table was discussed to some length. To resolve the question a straw vote was taken on the following statement: "Note that the ISO recommends that the national usage position 2/4 be assigned as a national currency symbol and that the preferred symbol for position 5/12, when this position is not required for alphabetic extension, be a second currency symbol. This standard does not include a second currency symbol." This recieved a vote of 4 in favor, 3 against and no abstentions.

6. Appendices to the Proposed Revised ASCII

The second draft of the Appendices (X3.2.4/53) to the proposed revision of ASCII was reviewed with several additions and deletions being made. The resultant document will bear the same number as the "Draft Proposed Revised American Standard for Information Interchange", and be dated October 21, 1964, X3.2.4/64.

7. Expository Remarks to the Proposed Revised ASCII

The document X3.2.4/41, Expository Remarks, was reviewed and revised. The resultant new document will be included with the draft proposal for revision of ASCII, X3.2.4/64.

8. Mailing of Draft Proposed Revision of ASCII

The Draft Proposed Revised ASCII will be mailed to the Members of X3.2 for review and comment on or before November 1, 1964.

9. Next Meeting

The next meeting of Task Group X3.2.4 will be at BEMA Headquarters, New York City, November 30, December 1 and 2, 1964.

E. F. Vidro, Jr.

E.F. Vidro, Jr.
Secretary X3.2.4

Tentative
7-BIT CODE
C.C.I.T.T. VERSION
9 October 1964

X3.2/165
October 30, 1964

X3.2.4/62

	0	1	2	3	4	5	6	7
0	(TC$_0$) Null	④(TC$_7$) DLE	Space	0	\` ①	P	@ ①	p
1	④(TC$_1$) SOH	④ DC$_1$	!	1	A	Q	a	q
2	④(TC$_2$) STX	④ DC$_2$	" ③	2	B	R	b	r
3	④(TC$_3$) ETX	④ DC$_3$	# ②	3	C	S	c	s
4	④(TC$_4$) EOT	DC$_4$ (Stop)	¤(CS)	4	D	T	d	t
5	(TC$_5$) WRU	④(TC$_8$) Nack	%	5	E	U	e	u
6	④(TC$_6$) ACK	(TC$_9$) Sync	&	6	F	V	f	v
7	Bell	④(TC$_{10}$) ETB	' ③	7	G	W	g	w
8	FE$_0$ (BS)	④ CNCL	(	8	H	X	h	x
9	FE$_1$ (HT)	EM	)	9	I	Y	i	y
10	FE$_2$ (LF)	④ SS	*	:	J	Z	j	z
11	FE$_3$ (VT)	④ ESC	+	;	K	[①	k	①
12	FE$_4$ (FF)	IS$_4$ (FS)	,	<	L	~ ①	l	①
13	FE$_5$ (CR)	IS$_3$ (GS)	−	=	M	] ①	m	①
14	④ SO	IS$_2$ (RS)	.	>	N	^ ①③	n	①
15	④ SI	IS$_1$ (US)	/	?	O	_	o	Del

① "Reserved for National Use" as alphabetic extensions. If not needed may be used for symbols.

② The # may have an alternate graphical representation (N°).

③ The graphics in positions 2/2, 2/7, 5/14 have the significance of quotation mark, apostrophe and upward arrow, respectively; however, these characters take on the significance of diaresis, acute accent and circumflex diacritical signs when they follow the Backspace code.

④ Reserved for further standardization, definition, or consideration.

X3.2.4/65
October 21, 1964

TO: The Members of ASA Subcommittee X3.2
and its Task Groups and Consultants

FROM: ASA Task Group X3.2.4

SUBJECT: Draft Proposed Revised American Standard Code for
Information Interchange (ASCII)

Enclosed is a copy of X3.2.4/64, October 20, 1964, Draft Proposed Revised ASCII, including the Foreword, the Standard, the Appendices, and the Expository Remarks, all in draft form.

You are requested to forward any comments on this draft material by November 27, 1964 to:

Mr. John L. Little
Room 247 CL
National Bureau of Standards
Washington, D. C. 20234

The comments received will be reviewed by Task Group X3.2.4 on November 30 and December 1, 1964, for inclusion prior to presentation to Subcommittee X3.2 on December 3, 1964, with a recommendation that the Proposed Revision of ASCII go out to the members of X3.2 for a Letter Ballot.

John L. Little
John L. Little
Chairman, X3.2.4

[illegible]

MM Att 30/5

X3.2.4/64
October 20, 1964

D R A F T

PROPOSED REVISED

AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE

2. STANDARD CODE

b7 b6 b5 → Bits					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	—	P	@	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SS	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	\	l	|
1	1	0	1	13	CR	GS	—	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	¬
1	1	1	1	15	SI	US	/	?	O	`	o	DEL

---

3. Character Representation

The standard 7-bit character representation, with b_7 the high-order bit and b_1, the low-order bit, is shown below.

EXAMPLE: The bit structure representation for the character "K", positioned in column 4, row 11 is:

b_7	b_6	b_5	b_4	b_3	b_2	b_1
1	0	0	1	0	1	1

Note that the character "K" may also be represented by the notation "column 4, row 11" or alternately as "4/11." Bits b_7, b_6, and b_5 collectively form the column number in binary notation, and bits b_4, b_3, b_2, and b_1 collectively form the row number in binary notation.

4.2 Graphic Characters

COLUMN/ROW	SYMBOL	NAME
2/0	SP	Space, normally non-printing
2/1	!	Exclamation mark
2/2	"	Quotation Marks (Diaeresis*)
2/3	#	Number Sign
2/4	$	Dollar Sign
2/5	%	Percent
2/6	&	Ampersand
2/7	'	Apostrophe; Closing Single Quotation Mark; (Acute Accent*)
2/8	(	Opening Parenthesis
2/9	)	Closing Parenthesis
2/10	*	Asterisk
2/11	+	Plus
2/12	,	Comma
2/13	-	Hyphen; Minus
2/14	.	Period; Decimal Point
2/15	/	Slant (Virgule, Solidus)
3/10	:	Colon
3/11	;	Semi-colon
3/12	<	Less than
3/13	=	Equals
3/14	>	Greater than
3/15	?	Question Mark
4/0	_	Underline

COLUMN/ROW	SYMBOL	NAME
5/11	[	Opening Bracket
5/12	\	Reverse Slant
5/13	]	Closing Bracket
5/14	^	Up Arrow; (Circumflex or Tilde*)
5/15	`	Opening Single Quotation Mark; (Grave Accent*)
6/0	@	Commercial At
7/11	{	Opening Brace
7/12	|	Vertical Line
7/13	}	Closing Brace
7/14	¬	Overline, Negation

*The use of the symbols in 2/2, 2/7, 5/14 and 5/15 as diacritical ~~signs~~ MARKS is described in Appendix A, paragraph A5.2.

5.1
(CC
(FE
(IS)
5.2
NU
SO
beg
adc
"he
Sec
STX
sec
tra
fer
sta
ETX
a s
EO
dic
mo
EN
cor
The
AC
rec
BE
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23/72 Jun 65

EXTENDED BCD INTERCHANGE CODE

CSS	2-8015	002
Cat.	Subject	suffix

IBM

CORPORATE

SYSTEMS STANDARD

NMAH

310/5

INTRODUCTION

1.1 SCOPE. This standard defines for the IBM Corporation the BCD coded representation for up to 256 graphics and controls in punched cards, in magnetic tape, and in 8 - Bit BCD CPU's. It also defines a collating sequence.

This standard includes:

(a) The 256 characters, Extended BCD Card Code.

(b) The 256 character, 8 - Bit Extended BCD CPU Code.

(c) The 256 character, 8 - Bit Extended BCD Magnetic Tape Code.

(d) The collating sequence for the 256 characters.

(e) Control characters, graphic characters, and characters with special meaning.

(f) Names for some of the characters.

(g) Specific characters for use in programming products.

NOTE: Missing Sections

1. Page 1: Part of Introduction - tells where the standard applies (Systems/360, for examle)
2. Page 1: Part of Introduction - effective date for compliance within IBM (now understood to be April 2, 1965).
3. Final pages (11 and 12) - No information available; understood to be redundant.

~~ATTACHMENTS:~~

~~SOURCE OF ADDITIONAL CC OF ATTACHMENTS.~~

REQUIREMENTS

2.1 EXTENDED BCD CARD CODE. The 256 character, twelve - row card code is given in Column 5 of Table IV.

2.2 EXTENDED BCD CPU AND MAGNETIC TAPE CODE. The 8 - Bit, Extended BCD CPU and Magnetic Tape Code is given in Column 6 of Table IV.

2.2.1 Track Assignment for Magnetic Tape. The Track Numbering for 9 - track, One - Half - Inch magnetic tape and for 10 - track, One - Inch magnetic tape and the correspondence between this Track Assignment and the 8 - Bits of the Extended BCD Magnetic Tape Code (Column 6 of Table IV) is shown in Table I.

2.3 REFERENCE NUMBERS. Reference numbers for the characters are given in Columns 1, 2, 3, and 4, of Table IV.

2.3.1 Column 1 gives reference numbers for the 256 characters of this standard, running 0, 1, 2, 3, ... 255.

2.3.2 Column 2 in this standard gives reference numbers for the 64 card and magnetic tape characters specified in BCDIC. The reference numbers given in Column 2 of this standard are called "Collating Numbers" in BCDIC. It is to be noted that where the Reference Number in Column 2 of this standard matches the Collating Number of BCDIC, the card codes also match, but graphics do not always match. A 6 - Bit BCD magnetic tape character translates to the 8 - Bit BCD character whose Reference Number in Column 2, Table IV of this standard matches the Collating Number in Column 1, Table I of BCDIC.

2.3.3 Column 3 gives Reference Numbers for PTTC/8 for use in 8 - Bit Environments. It is to be noted that where the Reference Numbers in Column 3 of this standard match the Reference Numbers in Column 1 of Tables I and II of PTTC/8, the card characters of this standard match the Extended Card Code characters in Column 5 of Tables I and II of PTTC/8, and the graphics of Column 7 of this standard also match the Duocase Alphabet Set - Column 7 of Tables I and II of PTTC/8.

2.3.4 Column 4 gives Reference Numbers for the Monocase PTTC/8. It is to be noted that where the Reference Numbers in Column 4 of Table IV of this standard match the Reference

Numbers in Column 1 of Tables I and II of PTTC/8, the card characters of this standard match the Basic Card Code Characters in Column 4 of Tables I and II of PTTC/8, and the graphics of Column 7 of this standard also match the Monocase Alphabet Set - Column 6 of Tables I and II of PTTC/8.

Table I. TRACK ASSIGNMENTS FOR MAGNETIC TAPE

9 track, 1/2 inch		10 track, 1 inch	
Bit Number	Track Number	Bit Number	Track Number
Reference Edge			
5	1		1 (Check bit)
7	2		2 (Check bit)
3	3	0	3
	4 (odd parity)	1	4
2	5	2	5
1	6	3	6
0	7	4	7
6	8	5	8
4	9	6	9
		7	10
		Reference Edge	

2.4 CONTROLS AND SPECIAL MEANINGS.

2.4.1 Controls. A number of the control characters specified in this standard are defined in PTTC/8 Environments. For the functions of these control characters, refer to Section 2.8 of that standard. These include those shown in Table II. Some of these control characters are applicable to display and image - processing devices.

2.4.1.1 SM - Set Mode (Reference Number 42). Sets a new mode of operation for image - processing devices.

2.4.1.2 DS - Digit Select (Reference Number 32). Causes either a digit from the source field or a fill character to be inserted in the result field, in CPU editing operations.

2.4.1.3 SOS - Start of Significance (Reference Number 33). Causes either a digit from the source field or a fill character to be inserted in the result field, and also indicates by setting a trigger, that the following digits are significant in CPU editing operations.

2.4.1.4 FS - Field Separator (Reference Number 34). Identifies individual fields in a multiple - field CPU editing operation.

2.4.2 BCD Interchange Code. Alternate Meanings. A number of the characters included in the graphic section of this standard have alternate meanings when used in 6 - Bit data processing systems. For the functions and special meanings of these characters, refer to Section 8 of BCDIC. These include those shown in Table III.

Table II. PERFORATED TAPE AND TRANSMISSION CONTROLS

Col. 1	Col. 3	Col. 8	
Reference Numbers (correspond to column Reference numbers of Table IV)			
4	61	PF	Punch Off
5	62	HT	Horizontal Tab
6	63	LC	Lower Case
7	64	DEL	Delete
20	45	RES	Restore
21	46	NL	New Line
22	47	BS	Backspace
23	48	IL	Idle
36	29	BYP	Bypass
37	30	LF	Line Feed
38	31	EOB	End of Block
39	32	PRE	Prefix
52	13	PN	Punch On
53	14	RS	Reader Stop
54	15	UC	Upper Case
55	16	EOT	End of Transmission
64	1	SP	Space

Table III. ALTERNATE CODE MEANINGS

Col. 1	Col. 2	Col. 7	Alternate Functions or Meanings
Reference Numbers			
79	5	|	GM: Group Mark
95	11	¬	MC: Mode Change
109	16	—	WS: Word Separator
111	18	?	SM: Segment Mark
122	19	:	SB: Substitute Blank
127	24	"	TM: Tape Mark
192	25		PZ: Plus Zero
208	35		MZ: Minus Zero
224	45		RM: Record Mark

2.4.3 Special Meanings. In card application involving overpunched numerics to indicate algebraic sign, Character Number 192 may have the meaning of Plus Zero, and Character Number 208 may have the meaning of Minus Zero.

2.5 STANDARD GRAPHICS. Column 7 of Table IV gives the Standard Graphics to be used with this standard.

2.5.1 Specific Characters for use in programming products. This standard assigns, for both machine systems and programming products, specific classification to characters as follows:

(a) Monocase or Uppercase alphabetics: (29 total)
A thru Z $ # @
(See Section 2.5.2.1 for Alphabetic Extenders)

(b) Lowercase alphabetics: (29 total)
a thru z ! " ¢
(See Section 2.5.2.1 for Alphabetic Extenders)

(c) Numerics: 0 thru 9

(d) Syntactics: (21 total - including SPACE)

/	*	+	-	=	SPACE
&	|	¬	<	>	
'	.	,	:	;	
(	)	%	_	?	

2.5.1.1 IBM Product Programs must accept, interpret, and process (1) Monocase Alphabetic Extenders in the same manner as Monocase Alphabetics, and (2) Lowercase Alphabetic Extenders in the same manner as Lowercase Alphabetics.

2.5.1.2 Under No Circumstances should new programming products be developed which require the use of characters (graphic and code) not as specified above. (Section 2.5.1)

2.5.1.3 The Only Programming Products exempted from the above requirement are:

Type I and Type II Programs Alpha tested prior to the effective date of this standard, and revisions or extensions of such Type I and Type II Programs.

2.5.2 National Graphic Options

2.5.2.1 Alphabetic Extenders. In countries where a Roman-based alphabet is used, alphabetic extenders are provided by replacement of some or all of the graphics # @ $ " ¢ ! as shown in Table V. These characters are indicated by AE (alphebetic extenders) in Column 8 of Table IV.

National graphic options for countries not shown in Table V may be added as the need arises but only with the approval of the Group Director of Standards.

2.5.2.2 Sterling. Whenever a character for 10 or 11 is required to appear in a single column of a card, the 11 or 12 punch, respectively, will be used.

2.5.2.3 KATAKANA and KANJI. In countries where required, the KATAKANA graphics are assigned as shown in Table VI. It is to be noted that some of these assignments coincide with assignments of lower case alphabetics. These characters are indicated by KA in Column 8 of Table IV.

In countries where required, characters reserved for future assignment to KANJI graphics are shown in Table VII. These characters are indicated by KI in Column 8 of Table IV. Assignment of specific KANJI graphics must have the prior approval of the Group Director of Standards.

2.5.2.4 Other Alphabets. For countries where other than Roman alphabets are required, assignment of characters for those alphabets may be incorporated in this standard but only with the approval of the Group Director of Standards.

2.6 STANDARD NAMES. In column 9 of Table IV are given standard names for some of the graphics and controls. When two names are given, as Minus, Hyphen, it is because two different meanings are associated with the graphic.

2.7 COLLATING SEQUENCE. The collating sequence of the 256 characters is defined by the Reference Numbers of Column 1 of Table IV, which run from 0 to 255, from low to high. The collating sequence of the 64 characters of BCDIC is given by the Reference Numbers of Column 2 of the Table, which run from low to high. It is to be noted that the collating sequence of the 64 character set is embedded in the collating sequence of the 256 character set.

2.8 GRAPHIC AND CONTROL ASSIGNMENTS.

2.8.1 Graphic Assignments. Characters in Table IV with Reference Numbers from 64 to 255 inclusive are reserved for assignment to graphic characters. Graphics are not yet assigned to character positions in Table IV with the following Reference Numbers:

65, 72, 73, 81, 88, 89, 104
105, 106, 112, 113, 120, 121, 192
202 to 208 inclusive, 218 to 225 inclusive
234 to 239 inclusive, 250 to 255 inclusive.

Assignment of specific graphics to any of these positions must have the prior approval of the Group Director of Standards.

2.8.2 Control Assignments. Characters in Table IV with Reference Numbers from 0 to 63 inclusive are reserved for assignment to control characters. Controls are not yet assigned to character positions in Table IV with the following Reference Numbers:

0 to 3 inclusive, 8 to 19 inclusive, 24 to 31 inclusive,
35, 40, 41, 43 to 51 inclusive, 56 to 63 inclusive.

Assignment of specific controls to any of these positions must have the prior approval of the Group Director of Standards.

SUPPLEMENTARY INFORMATION

3.1 16 by 16 CODE CHART. For reference purposes, bit-patterns, card-patterns, graphics and controls from Table IV are shown rearranged into a 16 by 16 matrix in Table VIII.

3.2 DIFFERENCES BETWEEN EQUIPMENT FOR BCDIC AND EBCDIC. It should be recognized that some equipment designed for use in 6-Bit BCD environments have different code-to-graphic assignments than those prescribed by this standard.

3.3 NAME OF CODE. In internal and external documents:

(a) The code of this standard should be referred to as the Extended BCD Interchange Code and may be abbreviated EBCDIC for convenience.

(b) The card code of EBCDIC should be referred to as the Extended BCD Card Code.

(c) The magnetic tape code of EBCDIC should be referred to as the Extended BCD Magnetic Tape Code.

(d) The CPU code of EBCDIC should be referred to as the Extended BCD CPU Code.

Table IV. CODE TABLE

1 2 3 4 Reference Numbers				5 Card Code						6 8-Bit Code		7 8 Graphics, Controls, and Special Meanings		9 Graphic and Control Names	10 See Section
256	64	111E	64B	12	11	0	9	8		0123	4567				
0				12		0	9	8	1	0000	0000				
1				12			9		1		0001				
2				12			9		2		0010				
3				12			9		3		0011				
4		61	61	12			9		4		0100		PF	Punch Off	2.4.1
5		62	62	12			9		5		0101		HT	Horizontal Tab	2.4.1
6		63	63	12			9		6		0110		LC	Lower Case	2.4.1
7		64	64	12			9		7		0111		DEL	Delete	2.4.1
8				12			9	8			1000				
9				12			9	8	1		1001				
10				12			9	8	2		1010				
11				12			9	8	3		1011				
12				12			9	8	4		1100				
13				12			9	8	5		1101				
14				12			9	8	6		1110				
15				12			9	8	7		1111				
16				12	11		9	8	1	0001	0000				
17					11		9		1		0001				
18					11		9		2		0010				
19					11		9		3		0011				
20		45	45		11		9		4		0100		RES	Restore	2.4.1
21		46	46		11		9		5		0101		NL	New Line	2.4.1
22		47	47		11		9		6		0110		BS	Backspace	2.4.1
23		48	48		11		9		7		0111		IL	Idle	2.4.1
24					11		9	8			1000				
25					11		9	8	1		1001				
26					11		9	8	2		1010				
27					11		9	8	3		1011				
28					11		9	8	4		1100				
29					11		9	8	5		1101				
30					11		9	8	6		1110				
31					11		9	8	7		1111				

Table IV. CODE TABLE (Con't.)

1 2 3 4 Reference Numbers				5 Card Code						6 8 - Bit Code		7 Graphics.	8 Controls, and Special Meanings	9 Graphic and Control Names	10 See Section
256	64	111E	64B	12	11	0	9	8		0123	4567				
32					11	0	9	8	1	0010	0000		DS	Digit Select	2.4.1.2
33						0	9		1		0001		SOS	Start of Significance	2.4.1.3
34						0	9		2		0010		FS	Field Separator	2.4.1.4
35						0	9		3		0011				
36		29	29			0	9		4		0100		BYP	Bypass	2.4.1
37		30	30			0	9		5		0101		LF	Line Feed	2.4.1
38		31	31			0	9		6		0110		EOB	End of Block	2.4.1
39		32	32			0	9		7		0111		PRE	Prefix	2.4.1
40						0	9	8			1000				
41						0	9	8	1		1001				
42						0	9	8	2		1010		SM	Set Mode	2.4.1.1
43						0	9	8	3		1011				
44						0	9	8	4		1100				
45						0	9	8	5		1101				
46						0	9	8	6		1110				
47						0	9	8	7		1111				
48				12	11	0	9	8	1	0011	0000				
49							9		1		0001				
50							9		2		0010				
51							9		3		0011				
52		13	13				9		4		0100		PN	Punch On	2.4.1
53		14	14				9		5		0101		RS	Reader Stop	2.4.1
54		15	15				9		6		0110		UC	Upper Case	2.4.1
55		16	16				9		7		0111		EOT	End of Transmission	2.4.1
56							9	8			1000				
57							9	8	1		1001				
58							9	8	2		1010				
59							9	8	3		1011				
60							9	8	4		1100				
61							9	8	5		1101				
62							9	8	6		1110				
63							9	8	7		1111				
64	0	1	1	No Punches						0100	0000		SP	Space	2.4.1
65				12		0	9		1		0001				
66				12		0	9		2		0010		KI		2.5.2.3
67				12		0	9		3		0011		KI		2.5.2.3
68				12		0	9		4		0100		KI		2.5.2.3
69				12		0	9		5		0101		KI		2.5.2.3
70				12		0	9		6		0110		KI		2.5.2.3
71				12		0	9		7		0111		KI		2.5.2.3
72				12		0	9	8			1000				
73		98		12				8	1		1001				
74		76		12				8	2		1010	¢	AE	Cent Sign	2.5.2
75	1	60	60	12				8	3		1011	.		Period, Decimal Point	
76	2	66		12				8	4		1100	<		Less Than Sign	
77	3	73		12				8	5		1101	(		Left Parenthesis	
78	4	100		12				8	6		1110	+		Plus Sign	
79	5	87		12				8	7		1111	|	GM	Vertical Bar, Logical OR	2.4.2

Table IV. CODE TABLE (Con't.)

1 2 3 4 Reference Numbers				5 Card Code						6 8 - Bit Code		7 8 Graphics, Controls and Special Meanings		9 Graphic and Control Names	10 See Section
256	64	111E	64B	12	11	0	9	8		0123	4567				
80	6	49	49	12						0101	0000	&		Ampersand	
81				12	11		9		1		0001				
82				12	11		9		2		0010		KI		2.5.2.3
83				12	11		9		3		0011		KI		2.5.2.3
84				12	11		9		4		0100		KI		2.5.2.3
85				12	11		9		5		0101		KI		2.5.2.3
86				12	11		9		6		0110		KI		2.5.2.3
87				12	11		9		7		0111		KI		2.5.2.3
88				12	11		9	8			1000				
89					11			8	1		1001				
90		99			11			8	2		1010	!	AE	Exclamation Point	2.5.2
91	7	44	44		11			8	3		1011	$	AE	Dollar Sign	2.5.2
92	8	72			11			8	4		1100	*		Asterisk	
93	9	74			11			8	5		1101	)		Right Parenthesis	
94	10	67			11			8	6		1110	;		Semi Colon	
95	11	111			11			8	7		1111	¬	MC	Logical NOT	2.4.2
96	12	33	33		11					0110	0000	-		Minus Sign, Hyphen	
97	13	18	18			0			1		0001	/		Slash	
98					11	0	9		2		0010		KI		2.5.2.3
99					11	0	9		3		0011		KI		2.5.2.3
100					11	0	9		4		0100		KI		2.5.2.3
101					11	0	9		5		0101		KI		2.5.2.3
102					11	0	9		6		0110		KI		2.5.2.3
103					11	0	9		7		0111		KI		2.5.2.3
104					11	0	9	8			1000				
105		86				0		8	1		1001				
106				12	11						1010				
107	14	28	28			0		8	3		1011	,		Comma	
108	15	69				0		8	4		1100	%		Percent Sign	
109	16	88				0		8	5		1101	_	WS	Underscore	2.4.2
110	17	71				0		8	6		1110	>		Greater Than Sign	
111	18	77				0		8	7		1111	?	SM	Question Mark	2.4.2
112				12	11	0				0111	0000				
113				12	11	0	9		1		0001				
114				12	11	0	9		2		0010		KI		2.5.2.3
115				12	11	0	9		3		0011		KI		2.5.2.3
116				12	11	0	9		4		0100		KI		2.5.2.3
117				12	11	0	9		5		0101		KI		2.5.2.3
118				12	11	0	9		6		0110		KI		2.5.2.3
119				12	11	0	9		7		0111		KI		2.5.2.3
120				12	11	0	9	8			1000				
121		110						8	1		1001				
122	19	68						8	2		1010	:	SB	Colon	2.4.2
123	20	12	12					8	3		1011	#	AE	Number Sign	2.5.2
124	21	17	17					8	4		1100	@	AE	At Sign	2.5.2
125	22	70						8	5		1101	'		Prime, Apostrophe	
126	23	65						8	6		1110	=		Equal Sign	
127	24	75						8	7		1111	"	AE, TM	Quotation Marks	2.4.2, 2.5.2

Table IV. CODE TABLE (Con't.)

1 2 3 4 Reference Numbers				5 Card Code						6 8 - Bit Code		7 8 Graphics, Controls and Special Meanings		9 Graphic and Control Names	10 See Section
256	64	111E	64B	12	11	0	9	8		0123	4567				
128				12		0		8	1	1000	0000		KI		2.5.2.3
129		50		12		0			1		0001	a	KA		
130		51		12		0			2		0010	b	KA		
131		52		12		0			3		0011	c	KA		
132		53		12		0			4		0100	d	KA		
133		54		12		0			5		0101	e	KA		
134		55		12		0			6		0110	f	KA		
135		56		12		0			7		0111	g	KA		
136		57		12		0			8		1000	h	KA		
137		58		12		0			9		1001	i	KA		
138				12		0		8	2		1010		KA		
139				12		0		8	3		1011		KI		
140				12		0		8	4		1100		KA		
141				12		0		8	5		1101		KA		
142				12		0		8	6		1110		KA		
143				12		0		8	7		1111		KA		
144				12	11			8	1	1001	0000		KA		
145		34		12	11				1		0001	j	KA		
146		35		12	11				2		0010	k	KA		
147		36		12	11				3		0011	l	KA		
148		37		12	11				4		0100	m	KA		
149		38		12	11				5		0101	n	KA		
150		39		12	11				6		0110	o	KA		
151		40		12	11				7		0111	p	KA		
152		41		12	11				8		1000	q	KA		
153		42		12	11				9		1001	r	KA		
154				12	11			8	2		1010		KA		
155				12	11			8	3		1011		KI		
156				12	11			8	4		1100		KI		
157				12	11			8	5		1101		KA		
158				12	11			8	6		1110		KA		
159				12	11			8	7		1111		KA		
160					11	0		8	1	1010	0000		KI		
161					11	0			1		0001		KI		
162		19			11	0			2		0010	s	KA		
163		20			11	0			3		0011	t	KA		
164		21			11	0			4		0100	u	KA		
165		22			11	0			5		0101	v	KA		
166		23			11	0			6		0110	w	KA		
167		24			11	0			7		0111	x	KA		
168		25			11	0			8		1000	y	KA		
169		26			11	0			9		1001	z	KA		
170					11	0		8	2		1010		KA		
171					11	0		8	3		1011		KI		
172					11	0		8	4		1100		KA		
173					11	0		8	5		1101		KA		
174					11	0		8	6		1110		KA		
175					11	0		8	7		1111		KA		2.5.2.3

Table IV. CODE TABLE (Con't.)

1 2 3 4 Reference Numbers				5 Card Code						6 8 - Bit Code		7 8 Graphics, Controls and Special Meanings		9 Graphic and Control Names	10 See Section
256	64	111E	64B	12	11	0	9	8		0123	4567		Sect. No.		
176				12	11	0		8	1	1011	0000		KI		2.5.2.3
177				12	11	0			1		0001		KI		
178				12	11	0			2		0010		KI		
179				12	11	0			3		0011		KI		
180				12	11	0			4		0100		KI		
181				12	11	0			5		0101		KI		
182				12	11	0			6		0110		KI		
183				12	11	0			7		0111		KI		
184				12	11	0			8		1000		KI		
185				12	11	0			9		1001		KI		
186				12	11	0		8	2		1010		KA		
187				12	11	0		8	3		1011		KA		
188				12	11	0		8	4		1100		KA		
189				12	11	0		8	5		1101		KA		
190				12	11	0		8	6		1110		KA		
191				12	11	0		8	7		1111		KA		2.5.2.3
192	25	59	59	12		0				1100	0000		PZ	Plus Zero	2.4.3
193	26	101	50	12					1		0001	A			
194	27	102	51	12					2		0010	B			
195	28	103	52	12					3		0011	C			
196	29	104	53	12					4		0100	D			
197	30	105	54	12					5		0101	E			
198	31	106	55	12					6		0110	F			
199	32	107	56	12					7		0111	G			
200	33	108	57	12					8		1000	H			
201	34	109	58	12					9		1001	I			
202				12		0	9	8	2		1010				
203				12		0	9	8	3		1011				
204				12		0	9	8	4		1100				
205				12		0	9	8	5		1101				
206				12		0	9	8	6		1110				
207				12		0	9	8	7		1111				
208	35	43	43		11	0				1101	0000		MZ	Minus Zero	2.4.3
209	36	89	34		11				1		0001	J			
210	37	90	35		11				2		0010	K			
211	38	91	36		11				3		0011	L			
212	39	92	37		11				4		0100	M			
213	40	93	38		11				5		0101	N			
214	41	94	39		11				6		0110	O			
215	42	95	40		11				7		0111	P			
216	43	96	41		11				8		1000	Q			
217	44	97	42		11				9		1001	R			
218				12	11		9	8	2		1010				
219				12	11		9	8	3		1011				
220				12	11		9	8	4		1100				
221				12	11		9	8	5		1101				
222				12	11		9	8	6		1110				
223				12	11		9	8	7		1111				

Table IV. CODE TABLE (Con't.)

1 2 3 4 Reference Numbers				5 Card Code						6 8 - Bit Code		7 8 Graphics, Controls, and Special Meanings		9 Graphic and Control Names	10 See Section
256	64	111E	64B	12	11	0	9	8		0123	4567		Sect. No.		
224	45	27	27			0		8	2	1110	0000		RM		2.4.2
225					11	0	9		1		0001				
226	46	78	19			0			2		0010	S			
227	47	79	20			0			3		0011	T			
228	48	80	21			0			4		0100	U			
229	49	81	22			0			5		0101	V			
230	50	82	23			0			6		0110	W			
231	51	83	24			0			7		0111	X			
232	52	84	25			0			8		1000	Y			
233	53	85	26			0			9		1001	Z			
234					11	0	9	8	2		1010				
235					11	0	9	8	3		1011				
236					11	0	9	8	4		1100				
237					11	0	9	8	5		1101				
238					11	0	9	8	6		1110				
239					11	0	9	8	7		1111				
240	54	11	11						0	1111	0000	0			
241	55	2	2						1		0001	1			
242	56	3	3						2		0010	2			
243	57	4	4						3		0011	3			
244	58	5	5						4		0100	4			
245	59	6	6						5		0101	5			
246	60	7	7						6		0110	6			
247	61	8	8						7		0111	7			
248	62	9	9						8		1000	8			
249	63	10	10						9		1001	9			
250				12	11	0	9	8	2		1010				
251				12	11	0	9	8	3		1011				
252				12	11	0	9	8	4		1100				
253				12	11	0	9	8	5		1101				
254				12	11	0	9	8	6		1110				
255				12	11	0	9	8	7		1111				

Table V. WTC NATIONAL GRAPHIC OPTIONS

				GRAPHIC CODES										
Reference Number	Card Code	8 - Bit Code	U. S. Graphic	FINLAND SWEDEN	DENMARK NORWAY	SPANISH SPEAKING	PORTUGUESE SPEAKING	GERMAN AUSTRIA	ITALY	FRANCE	UNITED KINGDOM			
74	12 - 8 - 2	0100 1010	¢	ö	ϕ		ã	ö			$			
90	11 - 8 - 2	0101 1010	!	å	å		ç	ü			!			
91	11 - 8 - 3	0101 1011	$	Å	Å		Ç	Ü			£			
123	8 - 3	0111 1011	#	Ä	AE	Ñ	Õ	Ä			#			
124	8 - 4	0111 1100	@	Ö	ϕ		Ã	Ö			@			
127	8 - 7	0111 1111	"	ä	æ	ñ	õ	ä			"			

Table VI. KATAKANA OPTIONS

Reference Number	KATAKANA CHARACTERS		CARD CODE
	Ref. No.	Graphic	
129	1	ア	12 - 0 - 1
130	2	イ	12 - 0 - 2
131	3	ウ	12 - 0 - 3
132	4	エ	12 - 0 - 4
133	5	オ	12 - 0 - 5
134	6	カ	12 - 0 - 6
135	7	キ	12 - 0 - 7
136	8	ク	12 - 0 - 8
137	9	ケ	12 - 0 - 9
138	10	コ	12 - 0 - 8 - 2
140	11	サ	12 - 0 - 8 - 4
141	12	シ	12 - 0 - 8 - 5
142	13	ス	12 - 0 - 8 - 6
143	14	セ	12 - 0 - 8 - 7
144	15	ソ	12 - 11 - 8 - 1
145	16	タ	12 - 11 - 1
146	17	チ	12 - 11 - 2
147	18	ツ	12 - 11 - 3
148	19	テ	12 - 11 - 4
149	20	ト	12 - 11 - 5
150	21	ナ	12 - 11 - 6
151	22	ニ	12 - 11 - 7
152	23	ヌ	12 - 11 - 8
153	24	ネ	12 - 11 - 9
154	25	ノ	12 - 11 - 8 - 2
157	26	ハ	12 - 11 - 8 - 5
158	27	ヒ	12 - 11 - 8 - 6
159	28	フ	12 - 11 - 8 - 7
162	29	ヘ	11 - 0 - 2
163	30	ホ	11 - 0 - 3
164	31	マ	11 - 0 - 4
165	32	ミ	11 - 0 - 5
166	33	ム	11 - 0 - 6
167	34	メ	11 - 0 - 7
168	35	モ	11 - 0 - 8
169	36	ヤ	11 - 0 - 9
170	37	ユ	11 - 0 - 8 - 2
172	38	ヨ	11 - 0 - 8 - 4
173	39	ラ	11 - 0 - 8 - 5
174	40	リ	11 - 0 - 8 - 6
175	41	ル	11 - 0 - 8 - 7
186	42	レ	12 - 11 - 0 - 8 - 2
187	43	ロ	12 - 11 - 0 - 8 - 3
188	44	ワ	12 - 11 - 0 - 8 - 4
189	45	ン	12 - 11 - 0 - 8 - 5
190	46	゛	12 - 11 - 0 - 8 - 6
191	47	・	12 - 11 - 0 - 8 - 7

Table VII. KANJI OPTIONS

Reference Numbers	KANJI CHARACTERS		CARD CODE
	Ref. No.	Graphic (1)	
128	1		12 - 0 - 8 - 1
139	2		12 - 0 - 8 - 3
155	3		12 - 11 - 8 - 3
156	4		12 - 11 - 8 - 4
160	5		11 - 0 - 8 - 1
161	6		11 - 0 - 1
171	7		11 - 0 - 8 - 3
176	8		12 - 11 - 0 - 8 - 1
177	9		12 - 11 - 0 - 1
178	10		12 - 11 - 0 - 2
179	11		12 - 11 - 0 - 3
180	12		12 - 11 - 0 - 4
181	13		12 - 11 - 0 - 5
182	14		12 - 11 - 0 - 6
183	15		12 - 11 - 0 - 7
184	16		12 - 11 - 0 - 8
185	17		12 - 11 - 0 - 9
66	18		9 - 12 - 0 - 2
67	19		9 - 12 - 0 - 3
68	20		9 - 12 - 0 - 4
69	21		9 - 12 - 0 - 5
70	22		9 - 12 - 0 - 6
71	23		9 - 12 - 0 - 7
82	24		9 - 12 - 11 - 2
83	25		9 - 12 - 11 - 3
84	26		9 - 12 - 11 - 4
85	27		9 - 12 - 11 - 5
86	28		9 - 12 - 11 - 6
87	29		9 - 12 - 11 - 7
98	30		9 - 11 - 0 - 2
99	31		9 - 11 - 0 - 3
100	32		9 - 11 - 0 - 4
101	33		9 - 11 - 0 - 5
102	34		9 - 11 - 0 - 6
103	35		9 - 11 - 0 - 7
114	36		9 - 12 - 11 - 0 - 2
115	37		9 - 12 - 11 - 0 - 3
116	38		9 - 12 - 11 - 0 - 4
117	39		9 - 12 - 11 - 0 - 5
118	40		9 - 12 - 11 - 0 - 6
119	41		9 - 12 - 11 - 0 - 7

NOTES:

(1) Graphics to be assigned individually by application.

(2) For applications requiring 17 or less KANJI characters, the codes selected must be from KANJI characters 1 - 17 inclusive.

APPENDIX E

Minutes of Meeting No. 16
X3.2.4
Code Assignments

X3.2/187
January 4, 1965

RECEIVED BEMA/DPG
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5/210 Hamm

Date: November 30, December 1-2, 1964
Place: BEMA Headquarters, New York City

1. Attendance

Attendees	Affiliation	Status	Nov.30	Dec.1	Dec.2
J.L. Little	National Bureau of Stds.	C	X	X	X
E.A. Avakian	Bunker-Ramo Corp.	M	X		X
J.B. Booth	Teletype Corp.	A		X	X
E.H. Clamons	Univac	A	X	X	X
C.J. Davis	IBM	M			
R.J. Donahue	Mergenthaler Linotype	M	X	X	X
W.F. Emmons	IBM	A	X	X	X
E.S. Fergusson	Rockford Research Institute	O	X	X	
R.B. Gibson	BTL	A			
J.G. Griffis	DCA	M	X	X	X
R.M. Gryb	AT&T	M			
G.V. Hawkins	IBM	O		X	
W.F. Huf	Navy	M			
J.D. Keen	Univac	M			
D.A. Kerr	BTL	M	X	X	X
E.J. Lewis	ITT-DISD	M			X
C.E. Mackenzie	IBM	O	X		
B.V. Magee	USAEL Ft. Monmouth	M	X	X	
R.F. Mundy	GSA	O	X	X	X
J.K. Nelson	Western Union	M	X	X	X
F.W. Smith	Western Union	A			
H. Spielman	RCA	M	X	X	X
H. Tholstrup	Friden	M			
L.R. Turner	NASA	M			
H.C. Umstead	USAEL-RDL	A	X		
E.F. Vidro, Jr.	Xerox Corporation	M	X	X	X
H.S. White, Jr.	DOD	O			X
G.E. Williams	Burroughs	O		X	X
J. Windhorst	Control Data	O		X	

C = Chairman
M = Member
A = Alternate
O = Observer

---

2. Membership

D.A. Kerr has been appointed the principal representative for BTL replacing W.Y. Lang who will be retiring in the near future.

R.B. Gibson has been appointed as Mr. Kerr's alternate.

R.F. Ewald, alternate for BTL. has resigned to accept the Chairman position of X3.2.6.

E.S. Fergusson had L.R. Turner's proxy for these meetings only.

3. Documents

The documents distributed at the meetings are X3.2.4/:

66 Comments on Document X3.2.4/64, October 20, 1964
From J.F. Auwaerter and E.H. Clamons to the Members of X3.2 and Affiliated Task Groups, November 23, 1964

67 ASCII Tape and Page Printing Symbols (Revised), October 25, 1964

68 Comments on Document X3.2.4/64, October 20, 1964
From J.F. Page, RCA, November 11, 1964

69 Letter Comment on Document X3.2.4/64, October 20, 1964
From E.A. Evakian to J.L. Little, November 20, 1964

70 Letter Comment on Document X3.2.4/64, October 20, 1964
From J. Windhorst to J.L. Little, November 18, 1964

71 Letter Comment on Revised ASCII Code Table
From E.H. Clamons to J.L. Little, October 5, 1964

72 Comments on Document X3.2/165 on Title for Task Group X3.2.4
From W.F. Emmons to Chairman, X3.2.4, November 20, 1964

73 Revision of Document X3.2.4/64, December 2, 1964

74 Tutorial Paper: Transparent-Mode Control Procedures for Data Communications, Using the American Standard Code for Information Interchange. Task Group Document X3.2.4/___.
Draft dated November 1964.

75 Name and Scope of X3.2.4. From Task Group X3.2.4 to ASA Subcommittee X3.2. Dated December 2, 1964 (became X3.2/174).

4. Minutes of Meetings 14 and 15

The minutes of meeting number 14 held in San Francisco, California, September 15-16 and meeting number 15 held at BEMA Headquarters in New York City, October 19-21 were approved as written.

5. Revision of Document X3.2.4/64

a. Mr. Kerr moved that Underline be assigned to position 5/15 and Opening Single Quotation mark (Grave Accent) be assigned to position 4/0 in the revised ASCII Code Table. This action was required as a result of the CCITT paper. This passed by a vote of 10-0-0.

b. E.H. Clamons moved, and, amended by C. Mackenzie, that ENQ bedefined as "A communication control character used in data communication systems as a request for a response from a remote station. It may be used as a "Who Are You" (WRU) to obtain station identification or may be used to obtain station status, or both". This passed by a vote of 9-1-0.

c. D.A. Kerr moved that the $ (page 25 Document X3.2.4/64) be retained in position 2/4 and the note be replaced by "The character in position 2/4 may be used internationally to indicate currency if the unit of currency intended is specified in the communication". This passed by a vote of 10-0-1.

d. Mr. Clamons moved that "X3.2.4 agrees with CCITT and recommends to ISO that CS_2 (second currency symbol) not be included in the 3rd Draft Proposal". This passed by a vote of 10-1-0.

e. Mr. Kerr moved that X3.2.4 support the use of Tilde (~) in position 5/12 for both ISO and revised ASCII. This passed by a vote of 8-1-1.

f. F.W. Emmons moved that Vertical Line (|) be placed in position 7/14, Overline (¬) in position 7/12, and Circumflex (^) in position 5/14. This passed by a vote of 8-1-2. During the discussion that preceded the vote, the Hatcheck (✓) was considered for inclusion in the above set.

g. X3.2.4 reaffirmed its position against the New Line concept as presented in the ISO 3rd Draft Proposal in the definition of LF (Line Feed). This position was reaffirmed by a vote of 11-0-1.

h. Mr. Kerr moved that the names of the symbols in positions 5/12 (~), 5/14 (^), 7/12 (¬), and 7/14 (|) be Tilde, Circumflex, Overline, and Vertical Line respectively. This motion was accepted by a vote of 8-0-1.

i. E.H. Clamons moved that the symbol (,) Comma may also be used as the diacritical "Cedilla" and its diacritical use should also be noted. This passed by a vote of 10-0-1.

j. Mr. Clamons also moved for the diacritical signs that "When so used, they should be preceded by an alphabetic character and a BS (Back Space) in that sequence". This passed by a vote of 5-1-4.

k. E.A. Avakian moved that "Task Group X3.2.4 reiterate the position taken at San Francisco on 8-bit representation of ASCII and leave Appendix B-3 as the proper statement". This motion passed by a vote of 7-2-1.

l. J.F. Auwaerter discussed the possible courses of action that the ISO could take regarding the CCITT recommendations for modifying the code table of the 3rd Draft Proposal. This helped X3.2.4 decide its course of action regarding the final writing of Document X3.2.4/73, Proposed Revised ASCII, which will be voted on by X3.2 (if accepted for vote) before January 18, 1964.

6. Task Group Name and Scope

a. Mr. Kerr proposed that "X3.2.4 reaffirm the acceptance of the San Francisco action of naming Task Group X3.2.4, Code Development". This passed by a vote of 9-0-1.

b. Reviewing the program of X3.2.4 presented at the San Francisco meeting and reviewing the scope of X3.2.4 as of July 1963, it was decided by the Task Group that a change of scope was in order. The older scope is as follows:

1) Compile and maintain the currently assigned control codes in PASCII.

2) Compile and analyze the requirements for additonal control codes and make recommendations.

As a result, Mr. Kerr proposed the following scope for X3.2.4: "To develop the coded character set for general information interchange and any revisions or variations which may be appropriate; to define associated characters, functions, and terms; to develop general logical conventions for the effective use of the code other than those associated purely with media representations or data communication procedures". This motion passed unanimously.

7. Transparency

To provide a basis for the discussion of transparency, Mr. Kerr moved that "X3.2.4 accept the Document X3.2.4/46 as the basis to develop definitions relating to transparency". This motion passed by a vote of 7-0-0.

The remaining time was spent discussing BTL's method of providing code transparency in their 8-bit system for ASCII.

8. Next Meeting

The next meeting of Task Group X3.2.4 will be January 19-20, 1965 at BEMA Headquarters, New York City.

E.F. Vidro, Jr.
Secretary

X3.2/187
January 4, 1965

Minutes of Meeting #41 - Subcommittee X3.2
December 3, 1964

Presiding Officer: Mr. L. L. Griffin, Chairman

Time: 9:00 am to 4:55 pm

Place: BEMA - New York, N. Y.

UMAH 310/5

1. Attendance

See Appendix A for attendance list

2. Minutes

The minutes of meeting #40 were approved after being corrected as follows:

2.1 Front sheet, Summary Item 1 - change "---- Subcommittee will include ----" to read "---- Subcommittee will consider including ----"

2.2 Page 3, Item 10.1 - change to complete sense of motion, "---- letter ballot." should be "---- letter ballot for final processing as an American Standard."

2.3 Page 3, Item 10.2 - change "---- letter ballot." to "---- letter ballot for final processing as an American Standard."

2.4 Page 4, Item 12.2 - action on motion not shown. Should be: "Approved, 14-0-0"

2.5 Page 5, Item 14.1 - incomplete report of motion. "---- structure for asynchronous ----" should be "---- structure for synchronous operation and only one structure for asynchronous ----"

3. Membership

Mr. W. H. McKenzie (ITT), approved as alternate member.
Mr. Chas. Crandell (NCR), approved as principal member.
Mr. R. J. Donahue (Mergenthaler), approved as principal member.
Mr. D. A. Kerr (BTL), status changed from alternate to principal member. (replacing W. Y. Lang)
Mr. G. E. Williams (Burroughs), approved as alternate member.
Mr. R. B. Gibson (BTL), nominated as second alternate member.
Mr. E. L. Clinkscales (DoD), nominated as second alternate.
Mr. D. A. Kerr will exercise proxy from Mr. E. A. Akakian, for this meeting.
Mr. Stan Erdreich (UNIVAC) introduced. Status action pending receipt of letter.
Mr. B. E. Summerton (World Trade Corp. IBM) introduced as observer.

X3.2/187
January 4, 1965

Appendix A

ATTENDANCE X3.2
MEETING DECEMBER 3, 1964
BEMA - NEW YORK, NEW YORK

NAME	ORGANIZATION	MEMBERSHIP STATUS
L. L. Griffin	Navy Department	Chairman
H. Tholstrup	Friden Inc.	M
F. W. Smith	Western Union	A
B. E. Summerton	World Trade Corp. (IBM)	O
C. E. Mackenzie	IBM	M
R. M. Ireland	SCM	M
R. B. Gibson	BTL	A(proposed)
D. A. Kerr	BTL	M
J. B. Booth	Teletype	A
G. E. Williams	Burroughs	O
R. J. Donahue	Mergenthaler Linotype Co.	M
E. L. Clinkscales	Defense Communications Agency	A
R. F. Ewald	BTL	A
W. H. McKenzie	ITT	M
W. J. Craven, Jr.	NAVCOSSACT	O
J. F. Auwaerter	Teletype	M
G. L. Murphy	Ampex	M
H. Spielman	RCA	M
J. Windhorst	CDC	M
R. E. Mullendore	Census	A
H. C. Umstead	USAEL	O
J. L. Little	NBS	M
R. F. Mundy	GSA	O
E. F. Vidro, Jr.	Xeroz	M
R. M. Brown	DoD	M
H. L. Gross	NCR	A
H. S. White, Jr.	Department of Defense	A
E. H. Clamons	UNIVAC	M
M. Ryherd	NCR	O
J. E. Taunt	GE	M
S. Erdreich	UNIVAC	O
R. M. Gryb	AT&T	M
M. Mendelsohn	Monroe	M
V. L. Thompson	UNIVAC	A

X3.2/172
December 3, 1964

PROPOSED REVISED

AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE

NMAH
310/5

The ASA Task Group X3.2.4, Code Development, which developed the proposal, had the following personnel:

J. L. Little, Chairman
National Bureau of Standards

H. Spielman, Former Chairman
Radio Corporation of America

E. F. Vidro, Jr., Secretary
Xerox Corporation

O. R. Arne
Formerly with Mergenthaler Linotype Co.

E. A. Avakian
Bunker-Ramo Corporation

J. B. Booth
Teletype Corporation

E. H. Clamons
UNIVAC Division, Sperry Rand Corp.

C. J. Davis
IBM Corporation

W. F. Emmons
IBM Corporation

R. F. Ewald
Bell Telephone Laboratories

E. S. Fergusson
Rockford Research Institute, Inc.

J. G. Griffis
Defense Communications Agency

W. F. Huf
Navy Department

D. A. Kerr
Bell Telephone Laboratories

W. Y. Lang
Bell Telephone Laboratories

E. J. Lewis
ITT Data & Information Systems Div.

E. F. Manning
Formerly with U. S. Army
Electronic Laboratories

J. K. Nelson
Western Union Telegraph Co.

L. R. Turner
National Aeronautics & Space Admin.

A. L. Whitman
Formerly with ITT Communication
Systems

It should be recognized that although X3.2 and X3.2.4 members are variously affiliated, work on an ASA subcommittee or task group is achieved primarily on an individual competence and experience basis.

X3.2/172
64 DEC 3

2. STANDARD CODE

Bits b7 b6 b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → ROW ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NULL	DLE	SP	0	`	P	@	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NACK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYNC	&	6	F	V	f	v
0	1	1	1	7	BELL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CNCL	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SS	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	~	l	¬
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	|
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

(COMPOSITOR'S NOTE, TO BE DELETED UPON PUBLICATION: PRINT CODE TABLE AND CHARACTER REPRESENTATION ON LEFT PAGE AND LEGEND ON ADJACENT RIGHT PAGE)

4. Legend

4.1 Control Characters

NULL	Null/Idle
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Test (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BELL	Audible or attention signal
BS	Backspace (FE)
HT	Horizontal Tabulation (punch card skip) (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In

DLE	Data Link Escape (CC)
DC1 DC2 DC3	Device Controls
DC4	Device Control (stop)
NACK	Negative Acknowledge (CC)
SYNC	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CNCL	Cancel
EM	End of Medium
SS	Start of Special Sequence
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

Note:

(CC)	Communication Control
(FE)	Format Effector
(IS)	Information Separator

4.2 Graphic Characters

COLUMN/ROW	SYMBOL	NAME
2/0	SP	Space (normally non-printing)
2/1	!	Exclamation Point
2/2	"	Quotation Marks (Diaeresis*)
2/3	#	Number Sign
2/4	$	Dollar Sign
2/5	%	Percent
2/6	&	Ampersand
2/7	'	Apostrophe (Closing Single Quotation Mark; Acute Accent*)
2/8	(	Opening Parenthesis
2/9	)	Closing Parenthesis
2/10	*	Asterisk
2/11	+	Plus
2/12	,	Comma (Cedilla*)
2/13	-	Hyphen (Minus)
2/14	.	Period (Decimal Point)
2/15	/	Slant
3/10	:	Colon
3/11	;	Semicolon
3/12	<	Less Than
3/13	=	Equals
3/14	>	Greater Than
3/15	?	Question Mark
4/0	`	[illegible]

COLUMN/ROW	SYMBOL	NAME
5/11	[	Opening Bracket
5/12	~	Tilde*
5/13	]	Closing Bracket
5/14	^	Circumflex *
5/15	_	Underline
6/0	@	Commercial At
7/11	{	Opening Brace
7/12	¬	Overline
7/13	}	Closing Brace
7/14	|	Vertical Line

*The use of the symbols in 2/2, 2/7, 2/12, 4/0, 5/12, and 5/14 as diacritical signs is described in Appendix A, paragraphs A5.2 and A5.3. When so used they should be preceded by an alphabetic character and a BS (Backspace) in that sequence.

These arrangements are:

Col/Row	Code Table Symbol	Use Punctuation	Diacritical
2/2	"	Quotation Marks	Diaeresis
2/7	´	Apostrophe	Acute Accent
2/12	,	Comma	Cedilla
4/0	`	Opening Single Quotation Mark	Grave Accent
5/12	~	(none)	Tilde
5/14	^	(none)	Circumflex

A5.3 Diacritical marks should be applied in this sequence: alphabetic character, BS (backspace), diacritical mark.

A5.4 The character overline is included because of its usefulness for such purposes as indicating negation or complementation. The "hook" on its code table representation is shown to suggest a means of avoiding confusion with underline.

A6. Graphic Subset Structure

A6.1 The basic structure of the dense graphic subset was influenced by logical collating considerations, the requirements of simple related 6-bit sets, and the needs of typewriter-like devices. For information processing, it is desirable that the characters be arranged in such a way as to minimize both the operating time and the hardware components required for ordering and sequencing operations. This requires that the relative order of characters, within classes, be such that a simple comparison of the binary codes will result in information being ordered in a desired sequence.

A6.2 Conventional usage requires that SP (space) be ahead of any other symbol in a collatable set. This permits a name such as "JOHNS" to collate ahead of a name such as "JOHNSON." The requirement that punctuation symbols such as comma also collate ahead of the alphabet ("JOHNS, A" should also collate before "JOHNSON") establish the special symbol locations, including SP, in the first column of the graphic subset.

A6.3 To simplify the design of typewriter-like devices, it is desirable that there by only a common 1-bit difference between characters to be paired on keytops. This, together with the requirements for a contiguous alphabet, and the collating requirements outlined above, resulted in the placement of the alphabet in the last four columns of the graphic subset and the placement of the numerals in the second column of the graphic subset.

A6.4 It is expected that devices having the capability of printing only 64 graphic symbols will continue to be important. It may be desirable to arrange these devices to print one symbol for the bit pattern of both upper and lower case of a given alphabetic letter. To facilitate this, there should be a single bit difference between the upper and lower case representations of any given letter. Combined with the requirement that a given case of the alphabet be contiguous, this dictated the assignment of the alphabet, as shown, in columns 4 through 7.

A6.5 To minimize ambiguity caused by the use of a 64-graphic as described above, it is desirable, to the degree possible, that each character in column 6 or 7 differ little in significance from the corresponding character in column 4 or 5. In certain cases, this was not possible.

A6.6 The assignment of commercial at (@) was dictated by the fact that, in certain countries, it will be replaced by a national symbol, most typically an accented lower case letter; therefore, it was located in column 6.

A6.7 The resultant structure of "specials" (S), "digits" (D), and "alphabetics" (A) does not conform to the most prevalent collating convention (S-A-D) because of other more demanding code requirements.

A6.8 The need for a simple transformation from the set sequence to the prevalent collating convention was recognized, and dictated the placement of some of the "specials" within the set. Specifically, those special symbols, viz., ampersand (&), asterisk (*), comma (,), hyphen (-), period (.), and slant (/), which are most often used as identifiers for ordering information and which normally collate ahead of both the alphabet and the numerals, were not placed in the column containing the numbers, so that the entire numeric column could be rotated via a relatively simple transformation to a position higher than the alphabet. The sequence of the aforementioned "specials" was also established to the extent practical to conform to the prevalent collating convention.

A6.9 The need for a useful 4-bit numeric subset also played a role in the placement of characters. Such a 4-bit subset, including the digits and the symbols asterisk, plus (+), comma, hyphen, period, and slant, can easily be derived from the code.

A6.10 Considerations of other domestic code sets, including the Department of Defense former standard 8-bit data transmission code (1961) ("Fieldata") as well as international requirements, played an important role in deliverations that resulted in the code. The selection and grouping of the symbols dollar sign ($), per cent (%), ampersand (&), apostrophe (´), less than (<), equals(=), and greater than (>) facilitate

SECTION 1

Introduction

1.1 This document relates to the proposed revision of the American Standard Code for Information Interchange (ASCII-ASA X3.4-1963) and discusses the difference between the proposed revision and the current standard, and explains why the changes were made.

1.2 The activity of Subcommittee X3.2, since the development of ASCII, has functioned within the scope and framework of ASA Document X3.4-1963. In addition Subcommittee X3.2 has engaged in close liaison and participation in the development of a 7-bit international information interchange code, in an attempt to make this code as effective as possible and as compatible with ASCII as is feasible. This international information interchange code has been developed, concurrently with the ASCII revision, by ISO/TC97/SC2 and reviewed by the CCITT, and serious efforts have been made to minimize the differences.

1.3 Specific activity was directed toward the unassigned area as prescribed in paragraphs A1.2 and B3 of document X3.4-1963. The assignment of the lower case of the alphabet to the unassigned area precipitated a review of the previous code assignments and in particular a review and re-evaluation of the control functions meriting inclusion in the code table. This resulted in a limited number of rearrangements, additions, and deletions of graphics and controls.

SECTION 2

ASCII Tables - X3.4-1963 and Proposed Revision

2.1 As an aid in following the development of the revision of ASCII, Figure 1 shows the proposed revised code table and the ASCII table (ASA X3.4-1963), in which changes are denoted by shaded areas.

SECTION 3

ISO 7-Bit Code Tables

First, Second and Third Draft Proposals

3.1 The parallel international developments are shown in Figures 2 and 3, where Figure 2 shows the changes between the first and second draft ISO 7-Bit Code Tables and Figure 3 illustrates the changes between the second and third (or present) draft ISO 7-Bit Code Tables.

3.2 Figures 2 and 3 are for reference only.

3.3 Figure 4 illustrates the ISO Third Draft Proposal (including the anticipated amendments) and the proposed revision of ASCII.

SECTION 4

Unassigned Area (Columns 6 & 7)

4.1 General Considerations

4.1.1 The published American Standard, X3.4-1963 contains 28 unassigned positions in the last two columns reserved for future standardization. After X3.4-1963 was published, Subcommittee X3.2 adopted the principle that all code positions shall have specific character assignments. In developing specific assignments, the following factors were weighed:

a. The relative need for extra graphics vs. extra control functions in the unassigned area of ASCII.

b. The need for a dual-case alphabet.

c. The implications of placing second-case letters in the unassigned area vs. placing them in the shift-out set with all 7 bits identical for the upper-and-lower case of each letter.

d. The merits of having upper-case vs. lower-case letters in the unassigned area.

e. The extensions required to accommodate foreign alphabets having more than 26 letters.

f. Methods of extending ASCII to provide many additional graphics and many additional controls.

g. Related subsets and supersets of ASCII for specialized uses, such as industry-wide choices.

h. Related subsets and supersets of ASCII for data processors, keyboards, printing devices, and local or remote stations.

could not be altered to facilitate this pairing without violating basic code principles.

5.3 Other Considerations

5.3.1 National Use Positions

5.3.1.1 The anticipated ISO 7-bit code table, illustrated in Figure 4, shows eleven national use positions identified by notes (3) and (4). Seven of the eleven national use positions have preferred graphic assignments as illustrated; these are included in the proposed revision of ASCII.

5.3.1.2 Subcommittee X3.2 made preferred assignments to the remaining four national use positions (7/11 through 7/14): the four graphics opening brace, overline, closing brace, and vertical line.

5.3.1.3 The criteria for assignments to positions 7/11 through 7/14 were as follows:

a. Because the last two columns may collapse over the preceding two columns in some application:

    1. Symbols should have similar form or usage.

    2. Symbols normally used for overprinting (e.e., those used with Backspace) should be assigned only to positions which collapse into other overprinting symbols.

b. Utility

5.3.2 "Commercial at" (@)

5.3.2.1 In the proposed revision of ASCII the "commercial at" is relocated to position 6/0. The reason for the change is that the French represent the "at" with a single accented lower case, therefore, the "@" should be in the lower case columns.

5.3.3 Underline

The addition of the control BS (Backspace) made practical the inclusion of the commonly used graphic underline. In the related codes used in some countries as many as 31 alphabetic characters will be required which have both upper and lower-case versions. The location of underline in position 5/15 accommodates this requirement; it has no lower-case equivalent, and thus does not suffer from its pairing with DEL (Delete).

The ASA Task Group X3.2.4, Code Development, which developed the proposal, had the following personnel:

J. L. Little, Chairman
National Bureau of Standards

H. Spielman, Former Chairman
Radio Corporation of America

E. F. Vidro, Jr., Secretary
Xerox Corporation

O. R. Arne
Formerly with Mergenthaler Linotype Co.

E. A. Avakian
Bunker-Ramo Corporation

J. B. Booth
Teletype Corporation

E. H. Clamons
UNIVAC Division, Sperry Rand Corp.

C. J. Davis
IBM Corporation

W. F. Emmons
IBM Corporation

R. F. Ewald
Bell Telephone Laboratories

E. S. Fergusson
Rockford Research Institute, Inc.

J. G. Griffis
Defense Communications Agency

W. F. Huf
Navy Department

D. A. Kerr
Bell Telephone Laboratories

W. Y. Lang
Bell Telephone Laboratories

E. J. Lewis
ITT Data & Information Systems Div.

E. F. Manning
Formerly with U. S. Army
Electronic Laboratories

J. K. Nelson
Western Union Telegraph Co.

L. R. Turner
National Aeronautics & Space Admin.

A. L. Whitman
Formerly with ITT Communication
Systems

It should be recognized that although X3.2 and X3.2.4 members are variously affiliated, work on an ASA subcommittee or task group is achieved primarily on an individual competence and experience basis.

3/015

X3.2/206
1965 January
21

2. Standard Code

b7 b6 b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
Bits b4 ↓	b3 ↓	b2 ↓	b1 ↓	COLUMN → ROW ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	`	P	@	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SS	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	~	l	¬
1	1	0	1	13	CR	GS	–	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	|
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Minutes of Meeting #43 — Subcommittee X3.2
March 4, 1965

Presiding Officer: Mr. L.L. Griffin, Chairman

Time: 9:00 AM to 4:45 PM

Place: BEMA — New York, N.Y.

1. Attendance - Appendix A.

2. Minutes of meeting #42 approved with following corrections:

Cover Sheet, Appendix - Change G through L to H through M. List G as "Report - Jt. Meeting on edge-punched cards".

Item 10.1 - Add new sentence "Motion approved 15-0-1".

Item 13.1 - Change X3.3.3 in first line to X3.3.

Appendix D - Organization name for Mr. G.L. Murphy, should be Ampex instead of Amplex.

Delete the ** item under X3.2/172 and add W.J. Osterman, Friden, casing a "Yes" vote as the alternate of Mr. Tholstrup. Also, change the totals to 23-1*-0.

3. Membership

S.A. Richardson (Monroe) approved as alternate member, replacing H. Rathbun.
C.A. Sykes (GE) approved as principal member, replacing J.E. Taunt.
R. Rudisch, (Communications Systems, Inc., until recently part of ITT), nominated as principal member.
M.R. Jepson (AT&T) nominated as principal member replacing R.M. Gryb.
D.A. Kerr named as proxy at this meeting for R.M. Gryb (AT&T).
H.L. Ryherd named as proxy at the afternoon session of this meeting for H.L. Gross (NCR).
A.P. Mullery has been named as liaison representative to X3.2 by X3.5.
The reference in the Minutes of Meeting #42 to S.M. Matsa (IBM) being nominated as liaison representative to X3.2 by EIA TR-31 should be changed to X3.2.1.

NMAH 310/5

APPENDIX A

Attendance X3.2 Meeting #43
BEMA - New York City - March 4, 1965

Name	Organization	Membership Status*
L.L. Griffin	Navy	C
J.F. Auwaerter	Teletype	M
J.B. Booth	Teletype	A
T.R. Bousquet	Honeywell	M
R.M. Brown	DoD	M
D.A. Carruthers	Bell Tel. Co. of Canada	O
E.H. Clamons	Univac	M
E.L. Clinkscales	DCA	A
R.J. Donahue	Mergenthaler Linotype Co.	M
S. Erdreich	Univac	O
R.F. Ewald	BTL	A
E.S. Fergusson	Rockford Research Inst., Inc.	O
H.L. Gross	NCR	A
R.M. Gryb	AT&T	M
M.R. Jepson	AT&T	M (Nominee)
D.A. Kerr	BTL	M
R. Rudisch	CSI	M (Nominee)
A.F. Lazowski	Univac	O
J.L. Little	NBS	M
C.E. Mackenzie	IBM	M
M. Mendelsohn	Monroe	M
R.E. Mullendore	Bur. Census	A
R.F. Mundy	GSA	O
G.L. Murphy	Ampex	M
J.K. Nelson	Western Union	M
G.E. Poorte	RCA	O
C.A. Sykes	GE	M
H. Tholstrup	Friden	M
V.L. Thompson	Univac	A
H.C. Umstead	USAEL	O
E.F. Vidro, Jr.	Xerox	M
H.S. White, Jr.	DoD	A
G.E. Williams	Burroughs	A
J. Windhorst	Control Data	M

* C - Chairman M - Member A - Alternate O - Observer

rétariat : **France**

ISO/TC 97/SC 2 (Secr. 37) 130 F/E

Mars 1965

ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION

Comité technique 97 : CALCULATEURS ET TRAITEMENT DE L'INFORMATION

Sous-Comité 2 : « JEUX DE CARACTÈRES ET CODAGE »

QUATRIÈME AVANT-PROJET

JEUX DE CARACTÈRES CODÉS A 6 ET 7 ÉLÉMENTS POUR L'ÉCHANGE D'INFORMATION ENTRE MATÉRIELS DE TRAITEMENT DE L'INFORMATION

FOURTH ISO DRAFT PROPOSAL

6 AND 7 BIT CODED CHARACTER SETS FOR INFORMATION PROCESSING INTERCHANGE

AFNOR

Association Française de Normalisation — 23, rue Notre-Dame-des-Victoires — Paris-2e

NMAH 310/5

BRIEF HISTORY

The present Recommendation was prepared by Technical Committee ISO/TC 97, Subcommittee 2, the Secretariat of which is held by AFNOR.

The Technical Committee began its work in 1962; national contributions were submitted at the Paris May 1962 meeting by the following (P) Members of Subcommittee 2 : France, Germany, Italy, United Kingdom, United States.

A synthesis of the various proposals was achieved and the resulting draft circulated for further discussions in October 1962.

After that meeting, Committee ISO/TC 97 circulated, for vote and comments, the first draft proposal [as contained in document ISO/TC 97/SC 2 (Secr. 12) 30 F/E, January 1963]. A majority (7 for, 3 against, and 2 not replying) was in favor of this draft proposal [see document ISO/TC 97/SC 2 (Secr. 14) 37].

During its October 1963 meeting, Subcommittee 2 considered the various comments received, and a second draft proposal [ISO/TC 97/SC 2 (Secr. 22) 75 F/E] embodied all the agreed amendments. Following Resolution N° 1 of this meeting, the second draft proposal was circulated for vote and comments among (P) and (O) Members of ISO/TC 97.

The result of this second letter ballot [as shown in document ISO/TC 97/SC 2 (Secr. 24) 77] was 11 for approval elgium, France, Germany, Italy, Japan, Poland, Spain, Sweden, Switzerland, United Kingdom, United States), none against. However, as most of the comments were of substance, document 75 was reconsidered at the New York meeting of ISO/TC 97/SC 2 (May, 11-15 1964).

The third draft proposal embodies all the amendments agreed upon during the May 1964 meeting.

The present document (fourth ISO draft proposal) has been drafted in order to incorporate some observations from the International Telegraph and Telephone Consultative Committee (CCITT), with the agreement of the ISO/TC 97 Secretariat and of the (P) Members of Subcommittee 2 (written consultation of January 1965).

This draft proposal is to be submitted to (P) Members of ISO/TC 97 for vote, and to (O) Members and liaison Organizations for information or possible comments.

11. TABLEAUX ET NOTES
TABLES AND NOTES

Jeux de caractères codés pour l'échange d'information entre matériels de traitement de l'information

Coded character sets for information processing interchange.

TABLEAU DE CODE A 6 ÉLÉMENTS D'INFORMATION

6 BIT SET TABLE

Bits						b$_6$ →	0	0	1	1
						b$_5$ →	0	1	0	1
b$_6$	b$_5$	b$_4$	b$_3$	b$_2$	b$_1$	Row \ Column	0	1	2	3
		0	0	0	0	0	F$_0$ Space	0	Null	P
		0	0	0	1	1	F$_1$ (HT)	1	A	Q
		0	0	1	0	2	F$_2$ (LF) ①	2	B	R
		0	0	1	1	3	F$_3$ (VT)	3	C	S
		0	1	0	0	4	F$_4$ (FF)	4	D	T
		0	1	0	1	5	F$_5$ (CR) ①	5	E	U
		0	1	1	0	6	SO	6	F	V
		0	1	1	1	7	SI	7	G	W
		1	0	0	0	8	(	8	H	X
		1	0	0	1	9	)	9	I	Y
		1	0	1	0	10	*	: ②	J	Z
		1	0	1	1	11	+	; ②	K	([) ③
		1	1	0	0	12	,	< ⑤ CS$_1$ ④	L	(CS$_2$) ④ ③
		1	1	0	1	13	−	= ⑤ %	M	(]) ③
		1	1	1	0	14	.	> ⑤ &	N	Esc
		1	1	1	1	15	/	´	O	Delete

ISO/TC 97/SC 2 (Secr. 37) 130 F/E

Février 1965

February 1965

NOTES RELATIVES AU TABLEAU DE CODE A 6 ÉLÉMENTS D'INFORMATION

① Les commandes CR et LF sont destinées aux appareils d'impression qui requièrent des combinaisons distinctes pour le retour de chariot et l'interligne.
Pour les appareils ne comportant qu'une seule commande pour l'opération combinée de retour de chariot et d'interligne, la fonction F_2 signifiera « Retour à la ligne » (NL). Ceci exige un accord entre l'émetteur des données et leur destinataire. F_5 signifiera alors « Retour arrière » (BS).

② S'il est nécessaire de représenter chacun des nombres 10 et 11 par un caractère unique (par exemple, pour les subdivisions de la Livre Sterling), ces nombres devront prendre respectivement les places de « deux points » (:) et de « point virgule » (;). Ces substitutions exigent un accord entre l'émetteur des données et leur destinataire.

③ « Réservé pour usage national ». Ces positions sont prévues principalement pour des extentions alphabétiques. Si elles ne sont pas requises pour de telles extensions, on peut les utiliser pour des symboles, et le choix recommandé est indiqué entre parenthèses.

④ La représentation graphique et la signification de chacun des deux symboles monétaires CS_1 (position 1/12) et CS_2 (position 3/12) peuvent varier en fonction des usages nationaux.
L'utilisation de ces symboles pour les échanges internationaux d'information pourra faire l'objet de recommandations ultérieures.

⑤ Il y a lieu de choisir l'un ou l'autre des deux groupes de trois symboles qui sont représentés dans ces positions : l'interprétation des combinaisons correspondantes exige un accord entre l'émetteur des données et leur destinataire.

NOTES ABOUT THE 6 BIT SET TABLE

① The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line.
For equipment which uses a single control for a combined carriage return and line feed operation, the function F_2 will have the meaning of « New Line » (NL). This requires agreement between the sender and the recipient of the data. F_5 will then have the meaning of « Backspace » (BS).

② If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of « colon » (:) and « semi-colon » (;) respectively. These substitutions require agreement between the sender and the recipient of the data.

③ « Reserved for National Use ». These positions are primarily intended for alphabetic extensions. If they are not required for that purpose they may be used for symbols and the recommended choice is shown in parentheses.

④ The graphical representation and the meaning of each of the two currency signs CS_1 (position 1/12) and CS_2 (position 3/12) may vary according to national use.
The use of these symbols for international information interchange may be the subject of future recommendations.

⑤ Either of the two sets of three symbols shown in these positions in the table may be chosen; the interpretation of the corresponding combinations requires agreement between the sender and the recipient of the data.

, Sec, 8c

Jeux de caractères codés pour l'échange d'information entre matériels de traitement de l'information.

Coded character sets for information processing interchange.

TABLEAU DE CODE A 7 ÉLÉMENTS D'INFORMATION

7 BIT SET TABLE

Bits				b_7 →	0	0	0	0	1	1	1	1
				b_6 →	0	0	1	1	0	0	1	1
				b_5 →	0	1	0	1	0	1	0	1
b_4	b_3	b_2	b_1	Row \ Column	0	1	2	3	4	5	6	7
0	0	0	0	0	(TC_0) Null	(TC_7) DLE	Space	0	`	P	(@) ③	p
0	0	0	1	1	(TC_1) SOH	DC_1	!	1	A	Q	a	q
0	0	1	0	2	(TC_2) STX	DC_2	" ⑧	2	B	R	b	r
0	0	1	1	3	(TC_3) ETX	DC_3	# ⑥	3	C	S	c	s
0	1	0	0	4	(TC_4) EOT	DC_4 (Stop)	CS_1 ④	4	D	T	d	t
0	1	0	1	5	(TC_5) Enq	(TC_8) Nack	%	5	E	U	e	u
0	1	1	0	6	(TC_6) Ack	(TC_9) Sync	&	6	F	V	f	v
0	1	1	1	7	Bell	(TC_{10}) ETB	' ⑧	7	G	W	g	w
1	0	0	0	8	FE_0 (BS)	Cncl	(	8	H	X	h	x
1	0	0	1	9	FE_1 (HT)	EM	)	9	I	Y	i	y
1	0	1	0	10	FE_2 (LF) ①	SS	*	: ②	J	Z	j	z
1	0	1	1	11	FE_3 (VT)	Esc	+	; ②	K	([) ③	k	③
1	1	0	0	12	FE_4 (FF)	IS_4 (FS)	,	<	L	(CS_2)④③	l	③
1	1	0	1	13	FE_5 (CR) ①	IS_3 (GS)	—	=	M	(]) ③	m	③
1	1	1	0	14	SO	IS_2 (RS)	.	>	N	^ ⑦ ⑧	n	③
1	1	1	1	15	SI	IS_1 (US)	/	?	O	_	o	Delete

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February 1965

NOTES RELATIVES AU TABLEAU DE CODE A 7 ÉLÉMENTS D'INFORMATION

① Les commandes CR et LF sont destinées aux appareils d'impression qui requièrent des combinaisons distinctes pour le retour de chariot et l'interligne.
Pour les appareils ne comportant qu'une seule commande pour l'opération combinée de retour de chariot et d'interligne, la fonction FE_2 signifiera « Retour à la ligne » (NL). Ceci exige un accord entre l'émetteur des données et leur destinataire.
L'emploi de cette fonction « NL » n'est pas autorisé en régime international sur les réseaux généraux de télécommunication (Réseau Télex et Réseau Téléphonique).

② S'il est nécessaire de représenter chacun des nombres 10 et 11 par un caractère unique (par exemple, pour les subdivisions de la Livre Sterling), ils devront prendre respectivement les places de « deux points » (:) et de « point virgule » (;). Ces substitutions exigent un accord entre l'émetteur des données et leur destinataire.
Sur les réseaux généraux de télécommunication, seuls les caractères « deux points » et « point virgule » sont autorisés en régime international.

③ « Réservé pour usage national ». Ces positions sont prévues principalement pour des extensions alphabétiques. Si elles ne sont pas requises pour de telles extensions, on peut les utiliser pour des symboles et un choix recommandé est indiqué entre parenthèses dans certains cas. Des restrictions limitent l'emploi de ces caractères sur les réseaux généraux de télécommunication en régime international.

④ La représentation graphique et la signification des deux symboles monétaires CS_1 (position 2/4) et CS $_2$(position 5/12) peuvent varier en fonction des usages nationaux.
L'utilisation de ces symboles pour les échanges internationaux d'information fera l'objet de recommandations ultérieures.

⑥ Le signe « numéro » (#), à la position 2/3, peut avoir une seconde représentation graphique (Nº).

⑦ La représentation du « tilde » (~) par l'« accent circonflexe » (^) est admissible pour les échanges internationaux d'information en espagnol et en portugais.

⑧ Les symboles graphiques qui figurent aux positions 2/2, 2/7, 5/14 signifient respectivement « guillemet », « apostrophe » et « flèche en haut »; cependant, ces caractères prennent la signification des signes diacritiques « tréma », « accent aigu » et « accent circonflexe » lorsqu'ils viennent à la suite d'un caractère « Retour arrière ».

NOTES ABOUT THE 7 BIT SET TABLE

① The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line.
For equipment which uses a single control for combined carriage return and line feed operation, the function FE_2 will have the meaning of « New Line » (NL). This requires agreement between the sender and the recipient of the data.
The use of this function « NL » is not allowed for international transmission on general telecommunication networks (Telex and Telephone networks).

② If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of « colon » (:) and « semi-colon » (;) respectively. These substitutions require agreement between the sender and the recipient of the data.
On the general telecommunication networks, the characters « colon » and « semi-colon » are the only ones authorized for international transmission.

③ « Reserved for National Use ». These positions are primarily intended for alphabetic extensions. If they are not required for that purpose, they may be used for symbols and a recommended choice is shown in parentheses in some cases.
Some restrictions are placed on the use of these characters on the general telecommunication networks for international transmission.

④ The graphical representation and the meaning of the two currency signs CS_1 (position 2/4) and CS_2 (position 5/12) may vary according to national use.
The use of these symbols for international interchange shall be the subject of future recommendations.

⑥ The « number sign » (#) in position 2/3 may have an alternate graphical representation (Nº).

⑦ It is acceptable to represent « tilde » (~) by « circumflex accent » (^) for international interchange of information in Spanish and Portuguese languages.

⑧ The graphics in positions 2/2, 2/7, 5/14 have respectively the significance of « quotation mark », « apostrophe » and « upwards arrow »; however, these characters take on the significance of « diaeresis », « acute accent » and « circumflex accent » diacritical signs when they follow the « Backspace » character.

Editor's Note

Publication of the following proposed American Standard, developed by a Subcommittee of ASA Sectional Committee X3, has been authorized by the American Standards Association for the purpose of obtaining comment, criticism and general public reaction, with the understanding that such proposed American Standard has not been finally accepted by ASA as a standard and, therefore, is subject to change, modification or withdrawal in whole or in part. Comments should be addressed to the Secretary X3, Business Equipment Manufacturers Association, 235 East 42 Street, New York, New York 10017.—E.L.

Proposed Revised
American Standard Code for Information Interchange

1. Scope

This coded character set is to be used for the general interchange of information among information processing systems, communication systems and associated equipment.

2. Standard Code

Bits b7 b6 b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	Column → Row ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	`	P	@	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SS	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	~	l	¬
1	1	0	1	13	CR	GS	–	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	|
1	1	1	1	15	SI	US	/	?	O	—	o	DEL

3. Character Representation

The standard 7-bit character representation, with b7 the high-order bit and b1 the low-order bit, is shown below.

Example. The bit representation for the character "K", positioned in column 4, row 11, is:

b7 b6 b5 b4 b3 b2 b1
1 0 0 1 0 1 1

The code table position for the character "K" may also be represented by the notation "column 4, row 11" or alternately as "4/11." The decimal equivalent of the binary number formed by bits b7, b6 and b5, collectively, forms the column number, and decimal equivalent of the binary number formed by bits b4, b3, b2 and b1, collectively, forms the row number.

4. Legend

4.1 *Control Characters*

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell (audible or attention signal)
BS	Backspace (FE)
HT	Horizontal Tabulation (punched card skip) (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control (stop)
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SS	Start of Special Sequence
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete*

(CC) Communication Control. (FE) Format Effector. (IS) Information Separator.

* In the strict sense, DEL is not a control character. See 5.2.

4.2 *Graphic Characters*

Column/Row	*Symbol*	*Name*
2/0	SP	Space (normally nonprinting)
2/1	!	Exclamation Point
2/2	"	Quotation Marks (diaeresis*)
2/3	#	Number Sign
2/4	$	Dollar Sign†
2/5	%	Percent
2/6	&	Ampersand
2/7	'	Apostrophe (closing single quotation mark; acute accent*)
2/8	(	Opening Parenthesis
2/9	)	Closing Parenthesis
2/10	*	Asterisk
2/11	+	Plus
2/12	,	Comma (cedilla*)
2/13	-	Hyphen (minus)
2/14	.	Period (decimal point)
2/15	/	Slant
3/10	:	Colon
3/11	;	Semicolon
3/12	<	Less Than
3/13	=	Equals
3/14	>	Greater Than
3/15	?	Question Mark
4/0	`	Grave Accent* (opening single quotation mark)†
5/11	[	Opening bracket†
5/12	~	Tilde*†
5/13	]	Closing bracket†
5/14	^	Circumflex*†
5/15	—	Underline
6/0	@	Commercial at
7/11	{	Opening brace
7/12	¬	Overline
7/13	}	Closing brace
7/14	|	Vertical line

* The use of the symbols in 2/2, 2/7, 2/12, 4/0, 5/12 and 5/14 as diacritical marks is described in Appendix A, paragraphs A5.2 and A5.3. When so used they should be preceded by an alphabetic character and a BS (Backspace) in that sequence.

† These characters should not be used in international interchange without determining that there is agreement between sender and recipient. (See Appendix B4).

5. Definitions

5.1 *General*

(CC) Communication Control. A functional character intended to control or facilitate transmission of information over communication networks.

(FE) Format Effector. A functional character which controls the layout or positioning of information in printing or display devices.

(IS) Information Separator. A character which is used to separate and qualify information in a logical sense. There is a group of four such characters, which are to be used in a hierarchical order.

5.2 *Control Characters*

NUL (Null). The all zeros character which may serve to accomplish time fill and media fill.

SOH (Start of Heading). A communication control character used at the beginning of a sequence of characters which constitute a machine-sensible address or routing information. Such a sequence is referred to as the *heading.* An STX character has the effect of terminating a heading.

STX (Start of Text). A communication control character which precedes a sequence of characters that is to be treated as an entity and entirely transmitted through to the ultimate destination. Such a sequence is referred to as *text.* STX may be used to terminate a sequence of characters started by SOH.

ETX (End of Text). A communication control character used to terminate a sequence of characters started with STX and transmitted as an entity.

EOT (End of Transmission). A communication control character used to indicate the conclusion of a transmission, which may have contained one or more texts and any associated headings.

ENQ (Enquiry). A communication control character used in data communication systems as a request for a response from a remote station. It may be used as a "Who Are You" (WRU) to obtain identification, or may be used to obtain station status, or both.

ACK (Acknowledge). A communication control character transmitted by a receiver as an affirmative response to a sender.

BEL (Bell). A character for use when there is a need to call for human attention. It may control alarm or attention devices.

BS (Backspace). A format effector which controls the movement of the printing position one printing space backward on the same printing line (applicable also to display devices).

HT (Horizontal Tabulation). A format effector which controls the movement of the printing position to the next in a series of predetermined positions along the printing line (applicable also to display devices and the skip function on punched cards).

LF (Line Feed). A format effector which controls the movement of the printing position to the next printing line (applicable also to display devices).

VT (Vertical Tabulation). A format effector which controls the movement of the printing position to the next in a series of predetermined printing lines (applicable also to display devices).

FF (Form Feed). A format effector which controls the movement of the printing position to the first predetermined printing line on the next form or page (applicable also to display devices).

CR (Carriage Return). A format effector which controls the movement of the printing position to the first printing position on the same printing line (applicable also to display devices).

SO (Shift Out). A control character indicating that the code combinations which follow shall be interpreted as outside of the character set of the standard code table until a Shift In character is reached.

SI (Shift In). A control character indicating that the code combinations which follow shall be interpreted according to the standard code table.

DLE (Data Link Escape). A communication control character which will change the meaning of a limited number of contiguously following characters. It is used exclusively to provide supplementary controls in data communication networks.

DC1, DC2, DC3, DC4 (Device Controls). Characters for the control of ancillary devices associated with data processing or telecommunication systems, more especially switching devices "on" or "off". (If a single "stop" control is required to interrupt or turn off ancillary devices, DC4 is the preferred assignment.)

NAK (Negative Acknowledge). A communication control character transmitted by a receiver as a negative response to the sender.

SYN (Synchronous Idle). A communication control character used by a sychronous transmission system in the absence of any other character to provide a signal from which synchronism may be achieved or retained.

ETB (End of Transmission Block). A communication control character used to indicate the end of a block of data for communication purposes. ETB is used for blocking data where the block structure is not necessarily related to the processing format.

CAN (Cancel). A control character used to indicate that the data with which it is sent is in error or is to be disregarded.

EM (End of Medium). A control character associated with the sent data which may be used to identify the physical end of the medium, or the end of the used, or wanted, portion of information recorded on a medium. (The position of this character does not necessarily correspond to the physical end of the medium.)

SS (Start of Special Sequence). A control character used to indicate the start of a variable length sequence of characters which have special significance or which are to receive special handling.

ESC (Escape). A control character intended to provide code extension (supplementary characters) in general information interchange. The Escape character itself is a prefix affecting the interpretation of a limited number of contiguously following characters.

FS (File Separator), GS (Group Separator), RS (Record Separator) and US (Unit Separator). These information separators may be used within data in optional fashion, except that their hierarchical relationship shall be: FS is the most inclusive, then GS, then RS, and US is least inclusive. (The content and length of a File, Group, Record or Unit are not specified.)

DEL (Delete). This character is used primarily to "erase" or "obliterate" erroneous or unwanted characters in perforated tape. (In the strict sense, DEL is not a control character.)

5.3 *Graphic Characters*

SP (Space). A normally nonprinting graphic character used to separate words. It is also a format effector which controls the movement of the printing position, one printing position forward (applicable also to display devices).

6. General Considerations

6.1 This standard does not define the means by which the coded set is to be recorded in any physical medium, nor does it include any redundancy or define techniques for error control. Further, this standard does not define data communication character structure, data communication formats, code extension techniques, or graphic representation of control characters.

6.2 Deviations from the standard may create serious difficulties in information interchange and should be used only with full cognizance of the parties involved.

6.3 The relative sequence of any two characters, when used as a basis for collation, is defined by their binary values.

6.4 No specific meaning is prescribed for any of the graphics in the code table except that which is understood by the users. Furthermore, this standard does not specify a type style for the printing or display of the various graphic characters.

6.5 The appendices (A-D) to this standard contain additional information on the design and use of this code.

Appendices

(These Appendices are not a part of American Standard Code for Information Interchange, but are included to facilitate its use.)

Appendix A. Design Considerations for the Coded Character Set

A1. Introduction

The standard coded character set is intended for the interchange of information among information processing systems, communication systems and associated equipment.

A2. Considerations Affecting the Code

There were many considerations that determined the set size, set structure, character selection and character placement of the code. Among these were (not listed in order of priority):

(1) Need for adequate number of graphic symbols
(2) Need for adequate number of device controls, format effectors, communication controls and information separators
(3) Desire for a nonambiguous code, i.e. one in which every code combination has a unique interpretation
(4) Physical requirements of media and facilities
(5) Error control considerations
(6) Special interpretation of the all-zeros and all-ones characters
(7) Ease in the identification of classes of characters
(8) Data manipulation requirements
(9) Collating conventions
  (a) Logical
  (b) Historical
(10) Keyboard conventions
  (a) Logical
  (b) Historical
(11) Other set sizes
(12) International considerations
(13) Programming languages
(14) Existing coded character sets

A3. Set Size

A 7-bit set is the minimum size that will meet the requirements for graphics and controls in applications involving general information interchange.

A4. Set Structure

A4.1 In discussing the set structure it is convenient to divide the set into 8 columns and 16 rows as indicated in the standard.

A4.2 It was considered essential to have a dense subset which contained only graphics. For ease of identification this graphic subset was placed in six contiguous columns.

A4.3 The first two columns were chosen for the controls for three reasons:

(1) The character NUL by its definition has the location 0/0 in the code table. NUL is broadly considered a control character.

(2) The representations in column 7 were felt to be most susceptible to simulation by a particular class of transmission error—one which occurs during an idle condition on asynchronous systems.

(3) To permit the considerations of graphic subset structure described in A6 to be satisfied, the two columns of controls had to be adjacent.

A4.4 The character set was structured to enable the easy identification of classes of graphics and controls.

A5. Choice of Graphics

A5.1 Included in the set are the numerals 0 through 9, upper and lower cases of the alphabetic letters A through Z, and those punctuation, mathematical and business symbols considered most useful. The set includes a number of characters commonly encountered in programming languages. In particular, all the COBOL and FORTRAN graphics are included.

A5.2 In order to permit the representation of languages other than English, two diacritical (or accent) marks have been included, and provision has been made for the use of four punctuation symbols alternately as diacritical marks. The pairing of these punctuation symbols with their corresponding diacritical marks was done so as to facilitate the design of a typeface which would be acceptable for both uses.

These arrangements are:

Column/ Row	*Code Table Symbol*	*Use*	
		Punctuation	*Diacritical*
2/2	"	Quotation Marks	Dialresis
2/7	'	Apostrophe	Acute Accent
2/12	,	Comma	Cedilla
4/0	‘	Opening Single, Quotation Mark	Grave Accent
5/12	~	(none)	Tilde
5/14	^	(none)	Circumflex

A5.3 Diacritical marks should be applied in this sequence: alphabetic character, BS (Backspace), diacritical mark.

A5.4 The character *overline* is included because of its usefulness for such purposes as indicating negation or complementation. The "hook" on its code table representation is shown to suggest a means of avoiding confusion with *underline*.

A6. Graphic Subset Structure

A6.1 The basic structure of the dense graphic subset was influenced by logical collating considerations, the requirements of simple related 6-bit sets, and the needs of typewriter-like devices. For information processing, it is desirable that the characters be arranged in such a way as to minimize both the operating time and the hardware components required for ordering and sequencing operations. This requires that the relative order of characters, within classes, be such that a simple comparison of the binary codes will result in information being ordered in a desired sequence.

A6.2 Conventional usage requires that SP (*space*) be ahead of any other symbol in a collatable set. This permits a name such as "JOHNS" to collate ahead of a name such as "JOHNSON." The requirement that punctuation symbols such as *comma* also collate ahead of the alphabet ("JOHNS, A" should also collate before "JOHNSON") establish the special symbol locations, including SP, in the first column of the graphic subset.

A6.3 To simplify the design of typewriter-like devices, it is desirable that there be only a common 1-bit difference between characters to be paired on keytops. This, together with the requirements for a contiguous alphabet, and the collating requirements outlined above, resulted in the placement of the alphabet in the last four columns of the graphic subset and the placement of the numerals in the second column of the graphic subset.

A6.4 It is expected that devices having the capability of printing only 64 graphic symbols will continue to be important. It may be desirable to arrange these devices to print one symbol for the bit pattern of both upper and lower case of a given alphabetic letter. To facilitate this, there should be a single bit difference between the upper and lower case representations of any given letter. Combined with the requirement that a given case of the alphabet be contiguous, this dictated the assignment of the alphabet, as shown, in columns 4 through 7.

A6.5 To minimize ambiguity caused by the use of a 64-graphic device as described above, it is desirable, to the degree possible, that each character in column 6 or 7 differ little in significance from the corresponding character in column 4 or 5. In certain cases, this was not possible.

A6.6 The assignment of *commercial at* (@) was dictated by the fact that, in certain countries, it will be replaced by a national symbol, most typically an accented lower case letter; therefore, it was located in column 6.

A6.7 The resultant structure of "specials" (S), "digits" (D), and "alphabetics" (A) does not conform to the most prevalent collating convention (S-A-D) because of other more demanding code requirements.

A6.8 The need for a simple transformation from the set sequence to the prevalent collating convention was recognized, and dictated the placement of some of the "specials" within the set. Specifically, those special symbols, viz., *ampersand* (&), *asterisk* (*), *comma* (,), *hyphen* (-), *period* (.) and *slant* (/), which are most often used as identifiers for ordering information and which normally collate ahead of both the alphabet and the numerals, were not placed in the column containing the numbers, so that the entire numeric column could be rotated via a relatively simple transformation to a position higher than the alphabet. The sequence of the aforementioned "specials" was also established to the extent practical to conform to the prevalent collating convention.

A6.9 The need for a useful 4-bit numeric subset also played a role in the placement of characters. Such a 4-bit subset, including the digits and the symbols *asterisk*, *plus* (+), *comma*, *hyphen*, *period* and *slant*, can easily be derived from the code.

A6.10 Considerations of other domestic code sets, including the Department of Defense former standard 8-bit data transmission code ["Fieldata," 1961] as well as international requirements, played an important role in deliberations that resulted in the code. The selection and grouping of the symbols *dollar sign* ($), *percent* (%), *ampersand* (&), *apostrophe* ('), *less than* (<), *equals* (=) and *greater than* (>) facilitate contraction to either a business or scientific 6-bit subset. The position of these symbols and of the symbols *comma*, *hyphen*, *period* and *slant* facilitates achievement of commonly accepted pairing on a keyboard. The historic pairing of *question mark* and *slant* is preserved and the *less than* and *greater than* symbols, which have comparatively low usage, are paired with *period* and *comma* so that in dual-case keyboard devices where it is desired to have *period* and *comma* in both cases, the *less than* and *greater than* symbols are the ones displaced. Provision was made for the accommodation of alphabets containing more than 26 letters and for 6-bit contraction by the location of low-usage characters in the area following the alphabet. In addition, the requirement for the digits 10 and 11 used in Sterling monetary areas was considered in the placement of the *asterisk*, *plus*, *semicolon*, and *colon*, so that the 10 and 11 could be substituted for the *semicolon* and *colon*.

A7. Control Subset Content and Structure

A7.1 The control characters included in the set are those required for the control of terminal devices, input and output devices, format, or communication transmission and switching on a general enough basis to justify inclusion in a standard set.

A7.2 Many control characters may be considered to fall into the following categories: (1) Communication Controls, (2) Format Effectors, (3) Device Controls, and (4) Information Separators. To the extent practical controls of each category were grouped, the structure chosen also facilitates the contraction of the set to a logically related 6-bit set.

A7.3 The information separators (FS, GS, RS, US) identify boundaries of various elements of information, but differ from punctuation in that they are primarily intended to be machine sensible. They were arranged in accordance with an expected hierarchical use, and the lower end of the hierarchy is contiguous in binary order with SP (space) which is sometimes used as a machine-sensible separator. Subject to this hierarchy the exact nature of their use within data is not specified.

A7.4 The character SYN (Synchronous Idle) was located so that its binary pattern in serial transmission was unambiguous as to character framing, and also to optimize certain other aspects of its communication usage.

A7.5 ACK (Acknowledge) and NAK (Negative Acknowledge) were located so as to gain the maximum practical protection against mutation of one into the other by transmission errors.

Appendix B. Notes on Application

B1. Introduction

B1.1 The standard code was developed to provide for information interchange among information processing systems, communications systems and associated equipment. In a system consisting of equipment with several local or native codes, maximum flexibility will be achieved if each of the native codes is translated to the standard whenever information interchange is desired.

B1.2 Within any particular equipment or closed system it may be necessary to substitute characters. For example, some systems may require special graphic symbols and some devices may require special control codes. Design efforts on the standard code included consideration of these types of adaptations.

B2. Character Substitutions

B2.1 Any character substitution will result in a coded character set which does not conform to this standard.

B2.2 It is recommended that when a character is substituted in the code table for a standard character, the standard character should not be reassigned elsewhere in the table. Such a substitute character, once assigned, should not be subsequently reassigned elsewhere.

B2.3 It is recommended that graphic substitutions be made only in the graphic area and control substitutions only in the control area. Any substitution involving a control should be made only with full cognizance of all possible operational effects.

B2.4 It should be noted that this standard specifies, for each position of the code table, the information represented by the character and not necessarily the precise action taken by the recipient when the character is received. In the case of graphics, considerable variation in the actual shape printed or displayed may be appropriate to different units, systems, or fields of application. In the case of controls, the action performed is dependent upon the use for which the particular system is intended, the application to which it is being put, and a number of conventions established by the user or designer—some system-wide and some unique to a particular unit.

B2.5 Typical examples of diversity in execution not necessarily contrary to this standard are:

(1) A number of graphic symbols, other than that used in the code table, are used for *ampersand* in various type styles; still other symbols may be more appropriate to electronic display devices. The use of such alternate symbols does not in itself constitute deviation from the standard as long as *ampersand* is the concept associated with the character. Note that this does not necessarily restrict the use of such an alternate symbol design to mean "and"; in any type style *ampersand* may, of course, be used with arbitrary meaning.

(2) A card punch in one application may "skip" when the character HT (Horizontal Tabulation: used as skip) is presented to it; in another application the character HT may be recorded in the card without further action.

B3. Related Larger and Smaller Sets

Consideration has been given to the relationship between the standard set and sets of other sizes. A number of straightforward logical transformations are possible which result in a variety of sets related to the standard. None of the transformed sets are recognized by this standard.

B4. International Considerations

This standard conforms to the anticipated recommendations of the International Organization for Standardization (ISO) and the International Telephone and Telegraph Consultative Committee (CCITT) for a 7-bit code. The characters of this code are identical to those specified for international standardization by these bodies. Their recommendations are expected to permit national standardization by the various countries in eleven code table positions. These "national usage" positions and their assignments in this standard are as follows:

Column/Row	*Character (U.S.)*	*Column/Row*	*Character (U.S.)*
2/4	$	6/0	@
4/0	\	7/11	{
5/11	[	7/12	¬
5/12	~	7/13	}
5/13	]	7/14	|
5/14	^		

In international interchange of information these 11 characters should not be used except where it is determined that there is agreement between sender and recipient.

In addition, in other countries, the Number Sign "#" (in position 2/3) may be represented as "No".

B5. Communications Considerations

Certain control characters are designated as *communication controls.* They are:

SOH	(Start of Heading)	ACK	(Acknowledge)
STX	(Start of Text)	DLE	(Data Link Escape)
ETX	(End of Text)	NAK	(Negative Acknowledge)
EOT	(End of Transmission)	SYN	(Synchronous Idle)
ENQ	(Enquiry)	ETB	(End of Transmission Block)

These may be used by communication systems for their internal signaling, or for the exchange of information relating to the control of the communication system between that system and its end terminals. Some such systems may impose restrictions on the use of these communication control characters by the end terminals. For example, the use of some of them may be completely prohibited while others may be restricted to use in conformity with the formats and procedures required by the communication system for its operation.

Appendix C. Original Criteria

C1. Introduction

C1.1 This Appendix contains the original criteria upon which the design of the code was based. Not all criteria have been entirely satisfied. Some are conflicting, and the characteristics of the set represent accepted compromises of these divergent criteria.

C1.2 The criteria were drawn from communication, processing, and media recording aspects of information interchange.

C2. Criteria

C2.1 Every character of the code set shall be represented by the same number of bits (i.e. binary digits).

C2.2 The standard set shall be so structured as to facilitate derivation of logically related larger or smaller sets.

C2.3 In a code of n bits, all possible 2^n patterns of ones and zeros will be permitted and considered valid.

C2.4 The number of bits, n, shall be sufficient to provide for the alphabetic and numeric characters, commonly used punctuation marks, and other special symbols, along with those control characters required for interchange of information.

C2.5 The numerals 0 through 9 shall be included within a 4-bit subset.

C2.6 The numerals 0 through 9 shall be so represented that the four low-order bits shall be the binary-coded-decimal form of the particular numeral that the code represents. In the selection of the two characters immediately succeeding the numeral 9, consideration shall be given to their replacement by the graphics 10 and 11 to facilitate the adoption of the code in the Sterling monetary area.

C2.7 The interspersion of control characters among the graphic characters shall be avoided. The characters devoted to controls shall be easily separable from those devoted to graphics.

C2.8 Within the standard set, each character shall stand by itself and not depend on surrounding characters for interpretation.

C2.9 An entire case of the alphabet (A through Z) shall be included within a 5-bit subset. Consideration shall be given to the need for more than 26 characters in some alphabets.

C2.10 The letters of each case of the alphabet shall be assigned, in conventional order (A through Z), to successive, increasing binary representations.

C2.11 Suitable control characters required for communication and information processing shall be included.

C2.12 Escape functions that provide for departures from the standard set shall be incorporated.

C2.13 A simple binary comparison shall be sufficient to determine the order within each class of characters. (In this regard, the special graphics, the numerals and the alphabet are each defined as distinct classes.) Simple binary rules do not necessarily apply between classes when ordering information.

C2.14 Space (i.e. the space between words) must collate ahead of all other graphics.

C2.15 Special symbols used in the ordering of information must collate ahead of both the alphabet and the numerals.

C2.16 Insofar as possible, the special symbols shall be grouped according to their functions; for example, punctuation and mathematical symbols. Further, the set shall be so organized that the simplest possible test shall be adequate to distinguish and identify the basic alphabetic, numeric and special symbol subsets.

C2.17 Special symbols shall be placed in the set so as to simplify their generation by typewriters and similar keyboard devices. This criterion means, in effect, that the codes for pairs of characters that normally appear on the same keytops on a typewriter shall differ only in a common single-bit position.

C2.18 The set shall contain the graphic characters of the principal programming languages.

C2.19 The codes for all control characters shall contain a common, easily recognizable, bit pattern.

C2.20 The Null (000···) and Delete (111···) characters shall be provided.

Appendix D. Terminology

This appendix is intended to clarify the sense in which certain terms are used.

Bit—	Contraction of "binary digit".
Bit pattern—	The binary representation of a character.
Character—	A member of a coded character set; the binary representation of such a member and its graphic symbol or control function.
Code—	A system of discrete representation of a set of symbols and functions.

Expository Remarks

1. Introduction

1.1 This document relates to the proposed revision of the American Standard Code for Information Interchange (ASCII-ASA X3.4-1963) and discusses the difference between the proposed revision and the current standard, and explains why the changes were made.

1.2 The activity of Subcommittee X3.2, since the development of ASCII, has functioned within the scope and framework of ASA Document X3.4-1963. In addition, Subcommittee X3.2 has engaged in close liaison and participation in the development of a 7-bit international information interchange code in an attempt to make this code as effective as possible and as compatible with ASCII as is feasible. This international information interchange code has been developed, concurrently with the ASCII revision, by ISO/TC97/SC2 and reviewed by the CCITT, and serious efforts have been made to minimize the differences.

1.3 Specific activity was directed toward the unassigned area as prescribed in paragraphs A1.2 and B3 of document X3.4-1963. The assignment of the lower case of the alphabet to the unassigned area precipitated a review of the previous code assignments and in particular a review and reevaluation of the control functions meriting inclusion in the code table. This resulted in a limited number of rearrangements, additions, and deletions of graphics and controls.

2. ASCII Tables-X3.4-1963 and Proposed Revision

2.1 As an aid in following the development of the revision of ASCII, Figure 1 shows the proposed revised code table and the ASCII table (ASA X3.4-1963), in which changes are denoted by shaded areas.

3. ISO 7-Bit Code Tables (First, Second, Third and Fourth Draft Proposals)

3.1 The parallel international developments are shown in Figures 2 and 3, where Figure 2 shows the changes between the first and second draft ISO 7-Bit Code Tables and Figure 3 illustrates the changes between the second and third draft ISO 7-Bit Code Tables.

The following notes pertain to the ISO Code Tables (Figures 2 and 3). [I, II, III are used here to indicate First, Second and Third Drafts, respectively, for section numbers shown.—Ed. Note]

Section Number	
I1	The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and feed a line. As an alternative, for equipment which uses a single combination for a combined carriage-return and line-feed operation (called New-Line), NL will be coded at FE 2. Then FE 5 will be regarded as Backspace BS. If the latter type of equipment has to interwork with the former, it may be necessary to take steps to introduce the CR character.
II1	The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and feed a line. As an alternative, for equipment which uses a single combination (called New Line), for a combined carriage-return and line-feed operation. NL will be coded at FE 2. If the latter type of equipment has to interwork with the former, it may be necessary to take steps to introduce the CR character.
III1	The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line. For equipment which uses a single control for combined carriage return and line feed operation, the function FE 2 will have the meaning New Line (NL). This requires agreement between the sender and the recipient of the data.
I2, II2	If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of "colon" (:) and "semi-colon" (;) respectively.
III2	If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of "colon" (:) and "semi-colon" (;) respectively. These substitutions require agreement between the sender and the recipient of the data.
III3	"Reserved for National use". These positions are primarily intended for alphabetic extensions. If they are not required for that purpose, they may be used for symbols and a recommended choice is shown in parenthesis in some cases.
I4	In those countries in which the alphabet includes more than 26 letters, but no more than 29, the symbols located in the position indicated by 4 may be replaced by the additional characters of the extended alphabet.
II4	"Reserved for National use". These positions are primarily intended for alphabetic extensions. If they are not required for that purpose, they may be used for symbols and the recommended choice is shown in parenthesis.
III4	The graphical representation and meaning of the two currency signs CS_1 (position 2/4) and CS_2 (position 5/12) may vary according to national use.
I5, II5	If a second currency sign is required, it should take the place of "reverse slash" (\\).
I6	Reserved for future standardization work i.e. not available for individual choice.
II6	"Reserved for National use". A currency sign will be assigned to this position.
III6	The number sign (#) in position 2/3 may have an alternate graphical representation (No).
I7	Reserved for future standardization for use as an acknowledge signal.
II7	If an "Acknowledge" (ACK) signal is required it should be coded in this position and the "Underline" sign becomes its graphical representation.
III7	It is acceptable to represent tilde (~) by circumflex accent (^) for international interchange of information in Spanish and Portuguese languages. In Spanish and Portuguese speaking countries, the tilde may replace the circumflex accent in positions 5/14.
III8	The graphics in positions 2/2, 2/7, 5/14 have respectively the significance of quotation mark, apostrophe and upwards arrow; however these characters take on the significance of diaeresis, acute accent and circumflex accent diacritical signs when they follow the Backspace character. The symbol shown in position 5/15 did not receive any denomination other than grave accent which corresponds to its use as a diacritical sign.

3.2 Figures 2 and 3 are for reference only.

3.3 Figure 4 illustrates the anticipated ISO Fourth Draft Proposal and the proposed revision of ASCII.

4. Unassigned Area (Columns 6 and 7)

4.1 *General Considerations*

4.1.1 The published American Standard, X3.4-1963 contains 28 unassigned positions in the last two columns reserved for future standardization. After X3.4-1963 was published, Subcommittee X3.2 adopted the principle that all code positions shall have specific character assignments. In developing specific assignments, the following factors were weighed.

a. The relative need for extra graphics vs. extra control functions in the unassigned area of ASCII.

b. The need for a dual-case alphabet.

c. The implications of placing second-case letters in the unassigned area vs. placing them in the shift-out set with all 7 bits identical for the upper and lower case of each letter.

d. The merits of having upper-case vs. lower-case letters in the unassigned area.

e. The extensions required to accommodate foreign alphabets having more than 26 letters.

f. Methods of extending ASCII to provide many additional graphics and many additional controls.

g. Related subsets and supersets of ASCII for specialized uses, such as industry-wide choices.

h. Related subsets and supersets of ASCII for data processors, keyboards, printing devices and local or remote stations.

4.2 *Control versus Graphic Assignment*

4.2.1 The conclusion was reached by the Subcommittee that the previously unassigned area should receive specific assignments, either the other case of the alphabet or additional controls. The Subcommittee then considered the following arguments.

4.2.2 *Arguments for the Placement of Graphics in the Unassigned Area*

4.2.2.1 In order to provide for a keyboard shift operation between upper and lower case characters, as in office typewriter keyboards, without introducing delays to keyboard operation or requiring character storage, the unassigned area should be used for the second case of the alphabet.

4.2.2.2 Upper and lower case letters will be more widely used than special controls. One of the principal users will be the graphic arts industry which requires a dual-case alphabet.

4.2.2.3 Assuming the rule that substitute graphics in the basic mode (ASCII) and alternate graphics in the shift-out mode are to be restricted to the graphic positions in ASCII, a greater number of substitute and alternate graphics are available if graphics are assigned to the unassigned areas.

4.2.2.4 Discretely assigned dual-case letters are easier to represent directly in fixed-field documents such as punched cards, since shift characters would not be required.

4.2.2.5 For information retrieval, text manipulation, mathematics and other specialized fields more than 64 graphics are generally considered necessary.

4.2.3 *Arguments for the Placement of Controls in the Unassigned Area*

4.2.3.1 Many users of information interchange need additional controls that are not presently assigned positions in ASCII. If additional single character controls are not provided in the standard, the use of non-standard controls will proliferate.

4.2.3.2 The present code does not adequately consider the requirements of advanced communication systems.

4.2.4 *Argument Against the Placement of Controls in the Unassigned Area*

4.2.4.1 A number of the proposed controls may require additional protection against false generation. Such controls should be generated by a sequence of characters and preferably by a sequence of characters now assigned in ASCII rather than a repetition of a single character control occupying a new code position.

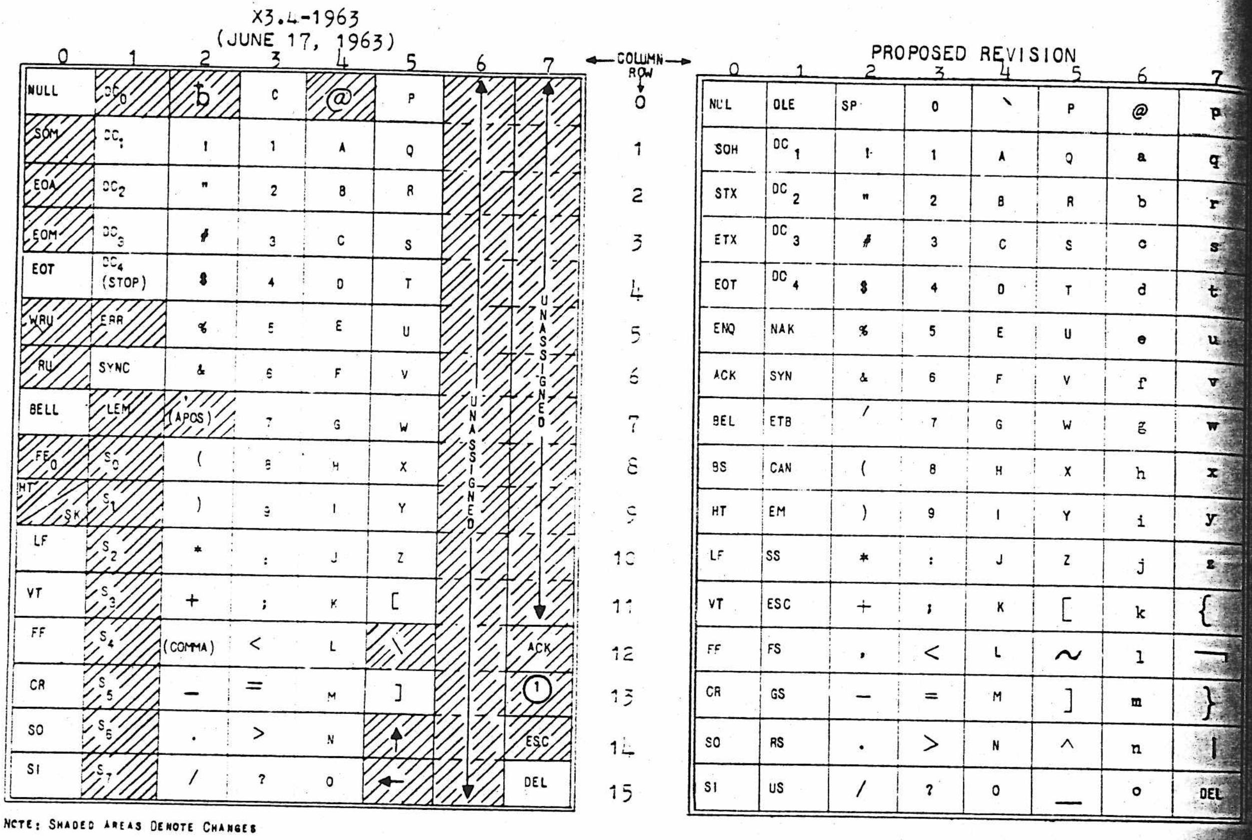
4.2.4.2 Since the use of coded characters as controls varies, it is difficult to know which of the many proposed characters need assignment in ASCII and where they should be placed.

4.2.5 *Arguments Against the Placement of Graphics in the Unassigned Area* (Arguments 4.2.5.2 and 4.2.5.3 were presented but have been wholly or partially negated by subsequent developments.)

4.2.5.1 The alphabetic sequence is already contained in ASCII. It is inefficient to have two nearly identical alphabetic sequences in the same basic code set. Shift characters could be used to shift to a second alphabet.

4.2.5.2 There is not really adequate room for the lower case alphabet in the unassigned area if it is desired to have an internationally acceptable code—the three Scandinavian letters following "z" will interfere with the controls in column 7.

4.2.5.3 If graphics were placed in the unassigned area and specifically in column 7, a mixture of controls (Acknowledge, Escape and Delete) and graphics within a column would exist and consequently would



X3.4-1963
(JUNE 17, 1963)

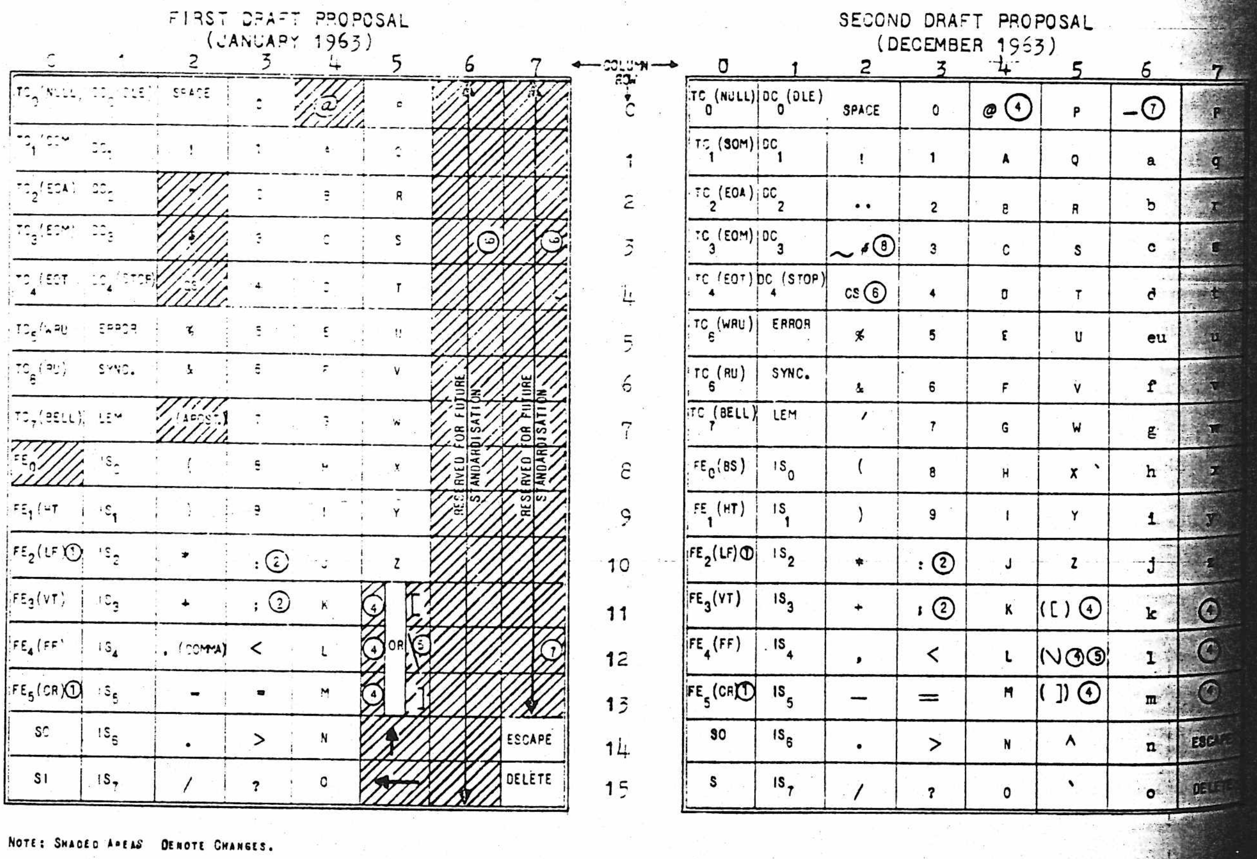
ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	NULL	DC$_0$	b̸	0	@	P	UNASSIGNED	UNASSIGNED
1	SOM	DC$_1$	!	1	A	Q		
2	EOA	DC$_2$	"	2	B	R		
3	EOM	DC$_3$	#	3	C	S		
4	EOT	DC$_4$ (STOP)	$	4	D	T		
5	WRU	ERR	%	5	E	U		
6	RU	SYNC	&	6	F	V		
7	BELL	LEM	' (APOS)	7	G	W		
8	FE$_0$	S$_0$	(	8	H	X		
9	HT SK	S$_1$	)	9	I	Y		
10	LF	S$_2$	*	:	J	Z		
11	VT	S$_3$	+	;	K	[		
12	FF	S$_4$	(COMMA)	<	L	\		ACK
13	CR	S$_5$	–	=	M	]		①
14	SO	S$_6$	.	>	N	↑		ESC
15	SI	S$_7$	/	?	O	←		DEL

NOTE: SHADED AREAS DENOTE CHANGES

PROPOSED REVISION

ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	`	P	@	p
1	SOH	DC$_1$	!	1	A	Q	a	q
2	STX	DC$_2$	"	2	B	R	b	r
3	ETX	DC$_3$	#	3	C	S	c	s
4	EOT	DC$_4$	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	/	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
10	LF	SS	*	:	J	Z	j	z
11	VT	ESC	+	;	K	[	k	{
12	FF	FS	,	<	L	~	l	¬
13	CR	GS	–	=	M	]	m	}
14	SO	RS	.	>	N	^	n	|
15	SI	US	/	?	O	_	o	DEL

FIG. 1. ASCII table (X3.4-1963) and proposed revised code table



FIRST DRAFT PROPOSAL
(JANUARY 1963)

ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	TC$_0$ (NULL)	DC$_0$ (DLE)	SPACE	0	@	P	RESERVED FOR FUTURE STANDARDISATION	RESERVED FOR FUTURE STANDARDISATION
1	TC$_1$ (SOM)	DC$_1$	!	1	A	Q		
2	TC$_2$ (EOA)	DC$_2$	"	2	B	R		
3	TC$_3$ (EOM)	DC$_3$	#	3	C	S	⑥	⑥
4	TC$_4$ (EOT)	DC$_4$ (STOP)	CS	4	D	T		
5	TC$_5$ (WRU)	ERROR	%	5	E	U		
6	TC$_6$ (RU)	SYNC.	&	6	F	V		
7	TC$_7$ (BELL)	LEM	(APOST.)	7	G	W		
8	FE$_0$	IS$_0$	(	8	H	X		
9	FE$_1$ (HT)	IS$_1$	)	9	I	Y		
10	FE$_2$ (LF) ①	IS$_2$	*	: ②	J	Z		
11	FE$_3$ (VT)	IS$_3$	+	; ②	K	④ [		
12	FE$_4$ (FF)	IS$_4$	, (COMMA)	<	L	④ OR ⑤ \		⑦
13	FE$_5$ (CR) ①	IS$_5$	–	=	M	④]		
14	SO	IS$_6$	.	>	N	↑		ESCAPE
15	SI	IS$_7$	/	?	O	←		DELETE

NOTE: SHADED AREAS DENOTE CHANGES.

SECOND DRAFT PROPOSAL
(DECEMBER 1963)

ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	TC$_0$ (NULL)	DC$_0$ (DLE)	SPACE	0	@ ④	P	– ⑦	P
1	TC$_1$ (SOM)	DC$_1$	!	1	A	Q	a	q
2	TC$_2$ (EOA)	DC$_2$	"	2	B	R	b	r
3	TC$_3$ (EOM)	DC$_3$	~ # ⑧	3	C	S	c	s
4	TC$_4$ (EOT)	DC$_4$ (STOP)	CS ⑥	4	D	T	d	t
5	TC$_5$ (WRU)	ERROR	%	5	E	U	eu	u
6	TC$_6$ (RU)	SYNC.	&	6	F	V	f	v
7	TC$_7$ (BELL)	LEM	'	7	G	W	g	w
8	FE$_0$ (BS)	IS$_0$	(	8	H	X `	h	x
9	FE$_1$ (HT)	IS$_1$	)	9	I	Y	i	y
10	FE$_2$ (LF) ①	IS$_2$	*	: ②	J	Z	j	z
11	FE$_3$ (VT)	IS$_3$	+	; ②	K	([) ④	k	④
12	FE$_4$ (FF)	IS$_4$	,	<	L	(\) ④ ⑤	l	④
13	FE$_5$ (CR) ①	IS$_5$	–	=	M	(]) ④	m	④
14	SO	IS$_6$	.	>	N	^	n	ESCAPE
15	S	IS$_7$	/	?	O	`	o	DELETE

FIG. 2. ISO 7-bit code (first and second draft proposals)

SECOND DRAFT PROPOSAL
(DECEMBER 1963)

ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	TC_0(NULL)	DC_0(DLE)	SPACE	0	(@) ④	P	_ ⑦	p
1	TC_1(SOM)	DC_1	!	1	A	Q	a	q
2	TC_2(EOA)	DC_2	..	2	B	R	b	r
3	TC_3(EOM)	DC_3	~ # ⑧	3	C	S	c	s
4	TC_4(EOT)	DC_4(STOP)	CS ⑤	4	D	T	d	t
5	TC_5(WRU)	ERROR	%	5	E	U	e	u
6	TC_6(RU)	SYNC	&	6	F	V	f	v
7	TC_7(BELL)	LEM	'	7	G	W	g	w
8	FE_0(BS)	IS_0	(	8	H	X	h	x
9	FE_1(HT)	IS_1	)	9	I	Y	i	y
10	FE_2(LF)①	S_2	*	: ②	J	Z	j	z
11	FE_3(VT)	IS_3	+	; ②	K	([) ④	k	④
12	FE_4(FF)	IS_4	,	<	L	(\) ④⑦	l	④
13	FE_5(CR)①	IS_5	—	=	M	(]) ④	m	④
14	SO	IS_6	.	>	N	^	n	ESCAPE
15	SI	IS_7	/	?	O	`	o	DELETE

NOTE: SHADED AREAS DENOTE CHANGES

THIRD DRAFT PROPOSAL
(MAY 1964)

ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	(TC_0)NULL	(TC_7)DLE	SPACE	0	—	P	(@) ③	p
1	(TC_1)SOH	DC_1	!	1	A	Q	a	q
2	(TC_2)STX	DC_2	" ⑧	2	B	R	b	r
3	(TC_3)ETX	DC_3	# ⑥	3	C	S	c	s
4	(TC_4)EOT	DC_4(STOP)	CS_1 ④	4	D	T	d	t
5	(TC_5)ENQ	(TC_8)NACK	%	5	E	U	e	u
6	(TC_6)ACK	(TC_9)SYNC	&	6	F	V	f	v
7	BELL	(TC_{10})ETB	' ⑧	7	G	W	g	w
8	FE_0(BS)	CNCL	(	8	H	X	h	x
9	FE_1(HT)	EM	)	9	I	Y	i	y
10	FE_2(LF)①	SS	*	: ②	J	Z	j	z
11	FE_3(VT)	ESC	+	; ②	K	([) ③	k	③
12	FE_4(FF)	IS_4(FS)	,	<	L	(CS_2) ③ ④	l	③
13	FE_5(CR)①	IS_3(GS)	—	=	M	(]) ③	m	③
14	SO	IS_2(RS)	.	>	N	^ ⑦⑧	n	③
15	SI	IS_1(US)	/	?	O	`	o	DELETE

FIG. 3. ISO 7-bit code (second and third draft proposals)

ANTICIPATED FOURTH DRAFT PROPOSAL

ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	(TC_0)NULL	(TC_7)DLE	SPACE	0	`	P ③	(@) ③	p
1	(TC_1)SOH	DC_1	!	1	A	Q	a	q
2	(TC_2)STX	DC_2	"	2	B	R	b	r
3	(TC_3)ETX	DC_3	#	3	C	S	c	s
4	(TC_4)EOT	DC_4(STOP)	CS_1 ③	4	D	T	d	t
5	(TC_5)ENQ	(TC_8)NACK	%	5	E	U	e	u
6	(TC_6)ACK	(TC_9)SYNC	&	6	F	V	f	v
7	BELL	(TC_{10})ETB	'	7	G	W	g	w
8	FE_0(BS)	CNCL	(	8	H	X	h	x
9	FE_1(HT)	EM	)	9	I	Y	i	y
10	FE_2(LF)①	SS	*	:	J	Z	j	z
11	FE_3(VT)	ESC	+	;	K	([) ③	k	③
12	FE_4(FF)	IS_4(FS)	,	<	L	(~) ③	l	③
13	FE_5(CR)①	IS_3(GS)	—	=	M	(]) ③	m	③
14	SO	IS_2(RS)	.	>	N	^③	n	③
15	SI	IS_1(US)	/	?	O	_	o	DELETE

ASCII
PROPOSED REVISION

ROW ↓ / COLUMN →	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	`	P	@	p
1	SOH	DC_1	!	1	A	Q	a	q
2	STX	DC_2	"	2	B	R	b	r
3	ETX	DC_3	#	3	C	S	c	s
4	EOT	DC_4	$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
10	LF	SS	*	:	J	Z	j	z
11	VT	ESC	+	;	K	[	k	{
12	FF	FS	,	<	L	~	l	¬
13	CR	GS	—	=	M	]	m	}
14	SO	RS	.	>	N	^	n	|
15	SI	US	/	?	O	_	o	DEL

③ National Use Positions (other footnotes not shown).

FIG. 4. ISO 7-bit code (fourth draft proposal and proposed revision)

increase the complexity of systems design, since bits b_7 and b_6 could not be used to indicate whether a character was a control or graphic.

4.3 *Assignment of the Lower Case Alphabet to the Unassigned Area*

4.3.1 Consideration of the above arguments led the Subcommittee to the conclusion that graphics, specifically the lower case of the alphabet, should be assigned to the presently unassigned area.

5. Graphic Assignments—Other than Alphabet

5.1 *Diacritical Marks*

5.1.1 The anticipated ISO 7-bit code table includes 3 diacritical marks (*grave accent*, *tilde* and *circumflex*) in positions 4/0, 5/12 and 5/14 and specifies that the graphics in positions 2/2 and 2/7 have the significance of *quotation marks* and *apostrophe* respectively, but take on the significance of the diacritical marks *diaeresis* and *acute accent* when they follow BS (Backspace)..

5.1.2 The ISO proposal to locate certain diacritical marks within the "international" area of the 7-bit code set appears to be a useful solution to the problem of multilingual international information interchange.

5.1.3 Subcommittee X3.2 accepted the principle of the use of *quotation marks* as *diaeresis* and *apostrophe* as *acute accent*. It was concluded that for increased utility the *opening single quotation mark* should be included in position 4/0; this mark may then serve as a *grave accent* when it appears above a letter, as may be done for all diacritical marks through the use of BS (Backspace). This action also compensated for the fact that an *apostrophe* which is shaped to allow its use as an *acute accent* can no longer be plausibly used as both opening and closing single quotation mark as has been the previous custom.

5.1.4 Provision has also been made for the use of the *comma* as the diacritical mark *cedilla* in a similar fashion.

5.2 *Keyboard Considerations*

5.2.1 Paragraph C2.17 of document X3.4-1963 gave as a criterion "that the codes for pairs of characters that normally appear on the same keytops on a typewriter shall differ only in a common single-bit position."

5.2.1.1 This was complied with in those cases where it did not conflict with basic principles of code design such as collating sequence, the translation requirements (in particular to and from numeric subsets), requirements for a dense graphic subset, etc.

5.2.2 The critical pairing on the same keytop of the underline with the hyphen, and the quotation marks with the apostrophe is characteristic of electric typewriters. The positions of these characters (and others) in the code table do not satisfy the one-bit criterion. The positioning of these four characters was reconsidered in Subcommittee X3.2 in the development of the present revision and it was reaffirmed that the structure of the code could not be altered to facilitate this pairing without violating basic code principles.

5.3 *Other Considerations*

5.3.1 *National Use Positions*

5.3.1.1 The anticipated ISO 7-bit code table, illustrated in Figure 4, shows eleven national use positions identified by note (3). Seven of the eleven national use positions have preferred graphic assignments as illustrated; these are included in the proposed revision of ASCII.

5.3.1.2 Subcommittee X3.2 made preferred assignments to the remaining four national use positions (7/11 through 7/14): the four graphics opening brace, overline, closing brace and vertical line.

5.3.1.3 The criteria for assignments to positions 7/11 through 7/14 were as follows:

a. Because the last two columns may collapse over the preceding two columns in some application: (1) symbols should have similar form or usage; and (2) symbols normally used for overprinting (e.g. those used with Backspace) should be assigned only to positions which collapse into other overprinting symbols.

b. Utility.

5.3.2 *Commercial at* (@)

5.3.2.1 In the proposed revision of ASCII the "commercial at" is relocated to position 6/0. The reason for the change is that the French represent the "at" with a single accented lower case, letter; therefore, the "@" should be in the lower case columns.

5.3.3 *Underline.* The addition of the control BS (Backspace) made practical the inclusion of the commonly used graphic *underline.* In the related codes used in some countries as many as 31 alphabetic characters will be required which have both upper- and lower-case versions. The location of *underline* in position 5/15 accommodates this requirement; it has no lower-case equivalent, and thus does not suffer from its pairing with DEL (Delete).

6. Control Assignments

6.1 Following the agreement to assign the lower case of the alphabet to the last two columns, the first two columns were reviewed to establish whether or not the present controls were those most generally required in the general interchange of information.

6.2 After a review of the control character assignments, which included liaison with Subcommittee X3.3, Data Transmission, a total of 32 were chosen. These were as follows:

NUL	(Null)	DLE	(Data Link Escape)
SOH	(Start of Heading)	DC1	(Device Control 1)
STX	(Start of Text)	DC2	(Device Control 2)
ETX	(End of Text)	DC3	(Device Control 3)
EOT	(End of Transmission)	DC4	(Device Control 4 (stop))
ENQ	(Enquiry)	NAK	(Negative Acknowledge)
ACK	(Acknowledge)	SYN	(Synchronous Idle)
BEL	(Bell (audible or attention signal))	ETB	(End of Transmission Block)
BS	(Backspace)	CAN	(Cancel)
HT	(Horizontal Tabulation)	EM	(End of Medium)
LF	(Line Feed)	SS	(Start of Special Sequence)
VT	(Vertical Tabulation)		
FF	(Form Feed)	ESC	(Escape)
CR	(Carriage Return)	FS	(File Separator)
SO	(Shift Out)	GS	(Group Separator)
SI	(Shift In)	RS	(Record Separator)
		US	(Unit Separator)

6.3 The following were involved in the selection of the above 32 controls.

6.3.1 The three transmission controls SOM (Start of Message), EOA (End of Address) and EOM (End of Message) were designated SOH (Start of Heading), STX (Start of Text) and ETX (End of Text) respectively to eliminate the confusion associated with the terms "Address" and "Message."

6.3.2 The control WRU (Who Are You?) was designated ENQ (Enquiry) to reflect the more general definition of this control.

6.3.3 In subsequent deliberations within Subcommittees X3.2 and X3.3 the relative importance of the function RU (Are You . . . ?) was reduced and consequently RU was eliminated from the proposed revised code table to make room for a higher priority control function.

6.3.4 The control ACK (Acknowledge) was moved from column 7 to allow for the extension of the lower case alphabet to 29 characters to satisfy the Scandinavian countries. It was agreed that this was a desirable control and should be placed in one of the first two columns. Acknowledge was placed in position 0/6 so that it lies within the communication control portion of the code, and to create the maximum practical bit difference between NAK (Negative Acknowledge) and ACK.

6.3.5 With the addition of the diacriticals and underline, the BS (Backspace) character was mandatory and was placed in position 0/8.

6.3.6 The device control DC_0 was reserved for DLE (Data Link Escape) in the X3.4-1963 standard. Additional studies in Task Group X3.3.4 substantiated the fact that a unique control character was required for use in data communications to provide a means of code extension for obtaining additional data communication link control functions.

6.3.7 The X3.4-1963 standard contains a control character designated ERR (Error) which was not defined in terms of its direction, or use. It was considered necessary to specify the direction and use, and as a result NAK (Negative Acknowledge) was designated as a backward acting communication control and CAN (Cancel) was designated as a forward acting end-to-end control.

6.3.8 The control ETB (End of Transmission Block) was considered during the development of ASCII but was given a lower priority. Subsequent deliberations, both within Subcommittee X3.2 and X3.3, have raised the relative importance of this control and it is, therefore, included in the proposed revised code table.

6.3.9 The control LEM (Logical End of Medium) was designated EM (End of Medium) to reflect the more general definition. It was moved down to position 1/9 so that all communication controls could be concentrated in the upper half of columns 0 and 1.

6.3.10 The control SS (Start of Special Sequence) was considered necessary as a single character control to indicate the start of variable length sequences of characters which have special significance or which are to receive special handling.

6.3.11 Escape was moved to position 1/11 so that all of the control characters would be in columns 0 and 1, thus b_7 and b_6 could be used to distinguish controls from graphics.

6.3.12 In concurrence with Subcommittee X3.4, Programming Languages, the number of information separators was reduced from eight to four. This was judged to be ample for general information interchange, especially since SP (Space), which is contiguous with the information separators, may also be used as an information separator. If any additions are required, it will be possible to obtain them by means of code extension. The separators were identified as FS (File Separator), GS (Group Separator), RS (Record Separator), and US (Unit Separator).

7. Bibliography

A complete bibliography is available on request from Secretary, Business Equipment Manufacturers Association, 235 East 42 Street, New York, New York 10017.

April 10, 1965

MEMORANDUM FOR FILE

Subject: Interrogating/Console Teletypewriter
Model 35 KSR for RCA Spectra 70 Series

Analysis of the coding and hardware characteristics of the subject unit leads to the following observations:

1. When displayed in the familiar rectangular chart the coding proposed for this unit is that shown in Figure 1. It is not a true EBCDIC coding, but rather is a modification of EBCDIC to meet the mechanical parameters of our Model 35 KSR.

2. The EBCDIC used internally in the IBM 360 as well as on IBM 9-track tape drives is shown in Figure 2. Comparison of Figures 1 and 2 shows that the symbol structures of the two codes are essentially unrelated, while the alphanumeric structures are moderately well related by groups. For example, the combinations for A through G are identical in both codes while the combinations for S through X differ in bit 7 only. Similarly the combinations for 0 through 7 differ in bits 7, 5 and 4 only.

3. The keyboard suggested is the same as used on our Model 35 KSR (ASCII coded) except that (in addition, to code bar coding changes) the SHIFT key rule is changed from "invert b_5 and maintain parity" to "set b_5 to 1 and b_8 to 0." This SHIFT change should not be difficult in our Model 35 keyboard.

4. Those 68 combinations of the 8-bit code (63 graphics, SPACE, and 4 controls) are uniquely defined by bits 1 through 7; thus bit 8 could be ignored in the printer, as I am sure the RCA people intend, and the resulting coding turns out as shown in Figure 3. This coding is the same in general structure as that used on the Model 35 KSR sets. Analysis of the proposed bit assignments for type box positioning shows that they are identical to those used on the Model 35 when ASCII encoded. Thus no new transfer mechanism is required.

5. The RCA specification does not state what the printer should do on receipt of any of the unassigned 8-bit combinations. It is an easy matter in the Model 35 to suppress printing on the left two, the center four and the right two columns of the 8-bit code, but it would be quite messy to selectively suppress printing in the unassigned portions of the remaining code columns. In all likelihood, RCA expects the receipt of any of the six unassigned combinations under Y Z, for example, would result in printing the horizontally associated symbol in column B_{8765} equal 0011.

Ja

JFA:LGP

J. F. AUWAERTER - 9400

NMAH 310 /5

ASA American Standards Association Incorporated
10 East 40th Street, New York, N.Y. 10016

X3.2/238
May 13, 1965

7C

XX 8368
April 27, 1965

To the P & O Members of ISO/TC 97,
Computers and Information Processing:

Gentlemen:

Enclosed herewith is the 4th Draft ISO Proposal on 6 and 7 Bit Coded Character Sets for Information Processing Interchange, document ISO/TC 97(Secr-45)78, and its Explanatory Report, document ISO/TC 97(Secr-46)79. This has just been received from AFNOR as secretariat of Subcommittee 2.

Also enclosed is letter ballot XX 8367 concerning the acceptance of the ISO Proposal.

We ask that you execute the ballot by no later than August 1, 1965.

Very truly yours,

V. G. Grey

V. G. Grey, For the
Secretariat ISO/TC 97

Encl. 97 N 78, 79 & XX 8367

cc: Liaison organizations
ISO/GS

CBI 67/1/24

II. TABLEAUX ET NOTES
TABLES AND NOTES

Jeux de caractères codés pour l'échange d'information entre matériels de traitement de l'information

Coded character sets for information processing interchange.

TABLEAU DE CODE A 6 ÉLÉMENTS D'INFORMATION

6 BIT SET TABLE

Bits b$_6$					0	0	1	1
b$_5$					0	1	0	1
b$_4$	b$_3$	b$_2$	b$_1$	Row \ Column	0	1	2	3
0	0	0	0	0	F$_0$ Space	0	Null	P
0	0	0	1	1	F$_1$ (HT)	1	A	Q
0	0	1	0	2	F$_2$ (LF) ①	2	B	R
0	0	1	1	3	F$_3$ (VT)	3	C	S
0	1	0	0	4	F$_4$ (FF)	4	D	T
0	1	0	1	5	F$_5$ (CR) ①	5	E	U
0	1	1	0	6	SO	6	F	V
0	1	1	1	7	SI	7	G	W
1	0	0	0	8	(	8	H	X
1	0	0	1	9	)	9	I	Y
1	0	1	0	10	*	: ②	J	Z
1	0	1	1	11	+	; ②	K	([) ③
1	1	0	0	12	,	< ⑤ CS$_1$ ④	L	(CS$_2$) ④ ③
1	1	0	1	13	−	= %	M	(]) ③
1	1	1	0	14	.	> &	N	Esc
1	1	1	1	15	/	´	O	Delete

ISO/TC 97/SC 2 (Secr. 37) 130 F/E

Février 1965

February 1965

X3.2/238
May 13, 1965

NOTES RELATIVES

AU TABLEAU DE CODE A 6 ÉLÉMENTS D'INFORMATION

① Les commandes CR et LF sont destinées aux appareils d'impression qui requièrent des combinaisons distinctes pour le retour de chariot et l'interligne.
Pour les appareils ne comportant qu'une seule commande pour l'opération combinée de retour de chariot et d'interligne, la fonction F_2 signifiera « Retour à la ligne » (NL). Ceci exige un accord entre l'émetteur des données et leur destinataire. F_5 signifiera alors « Retour arrière » (BS).

② S'il est nécessaire de représenter chacun des nombres 10 et 11 par un caractère unique (par exemple, pour les subdivisions de la Livre Sterling), ces nombres devront prendre respectivement les places de « deux points » (:) et de « point virgule » (;). Ces substitutions exigent un accord entre l'émetteur des données et leur destinataire.

③ « Réservé pour usage national ». Ces positions sont prévues principalement pour des extentions alphabétiques. Si elles ne sont pas requises pour de telles extensions, on peut les utiliser pour des symboles, et le choix recommandé est indiqué entre parenthèses.

④ La représentation graphique et la signification de chacun des deux symboles monétaires CS_1 (position 1/12) et CS_2 (position 3/12) peuvent varier en fonction des usages nationaux.
L'utilisation de ces symboles pour les échanges internationaux d'information pourra faire l'objet de recommandations ultérieures.

⑤ Il y a lieu de choisir l'un ou l'autre des deux groupes de trois symboles qui sont représentés dans ces positions : l'interprétation des combinaisons correspondantes exige un accord entre l'émetteur des données et leur destinataire.

NOTES ABOUT

THE 6 BIT SET TABLE

① The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line.
For equipment which uses a single control for a combined carriage return and line feed operation, the function F_2 will have the meaning of « New Line » (NL). This requires agreement between the sender and the recipient of the data. F_5 will then have the meaning of « Backspace » (BS).

② If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of « colon » (:) and « semi-colon » (;) respectively. These substitutions require agreement between the sender and the recipient of the data.

③ « Reserved for National Use ». These positions are primarily intended for alphabetic extensions. If they are not required for that purpose they may be used for symbols and the recommended choice is shown in parentheses.

④ The graphical representation and the meaning of each of the two currency signs CS_1 (position 1/12) and CS_2 (position 3/12) may vary according to national use.
The use of these symbols for international information interchange may be the subject of future recommendations.

⑤ Either of the two sets of three symbols shown in these positions in the table may be chosen; the interpretation of the corresponding combinations requires agreement between the sender and the recipient of the data.

Jeux de caractères codés pour l'échange d'information entre matériels de traitement de l'information.

Coded character sets for information processing interchange.

TABLEAU DE CODE A 7 ÉLÉMENTS D'INFORMATION

7 BIT SET TABLE

b$_7$					0	0	0	0	1	1	1	1
b$_6$					0	0	1	1	0	0	1	1
b$_5$					0	1	0	1	0	1	0	1
Bits	b$_4$	b$_3$	b$_2$	b$_1$	Column / Row	0	1	2	3	4	5	6	7
	0	0	0	0	0	(TC$_0$) Null	(TC$_7$) DLE	Space	0	`	P	(@) ③	p
	0	0	0	1	1	(TC$_1$) SOH	DC$_1$	!	1	A	Q	a	q
	0	0	1	0	2	(TC$_2$) STX	DC$_2$	" ⑧	2	B	R	b	r
	0	0	1	1	3	(TC$_3$) ETX	DC$_3$	# ⑥	3	C	S	c	s
	0	1	0	0	4	(TC$_4$) EOT	DC$_4$ (Stop)	CS$_1$ ④	4	D	T	d	t
	0	1	0	1	5	(TC$_5$) Enq	(TC$_8$) Nack	%	5	E	U	e	u
	0	1	1	0	6	(TC$_6$) Ack	(TC$_9$) Sync	&	6	F	V	f	v
	0	1	1	1	7	Bell	(TC$_{10}$) ETB	' ⑧	7	G	W	g	w
	1	0	0	0	8	FE$_0$ (BS)	Cncl	(	8	H	X	h	x
	1	0	0	1	9	FE$_1$ (HT)	EM	)	9	I	Y	i	y
	1	0	1	0	10	FE$_2$ (LF) ①	SS	*	: ②	J	Z	j	z
	1	0	1	1	11	FE$_3$ (VT)	Esc	+	; ②	K	([) ③	k	③
	1	1	0	0	12	FE$_4$ (FF)	IS$_4$ (FS)	,	<	L	(CS$_2$) ④ ③	l	③
	1	1	0	1	13	FE$_5$ (CR) ①	IS$_3$ (GS)	—	=	M	(]) ③	m	③
	1	1	1	0	14	SO	IS$_2$ (RS)	.	>	N	^ ⑦ ⑧	n	③
	1	1	1	1	15	SI	IS$_1$ (US)	/	?	O	_	o	Delete

X3.2/238
May 13, 1965

ISO/TC 97/SC 2 (Secr. 37) 130 F/E

Février 1965
February 1965

NOTES RELATIVES AU TABLEAU DE CODE A 7 ÉLÉMENTS D'INFORMATION

① Les commandes CR et LF sont destinées aux appareils d'impression qui requièrent des combinaisons distinctes pour le retour de chariot et l'interligne.
Pour les appareils ne comportant qu'une seule commande pour l'opération combinée de retour de chariot et d'interligne, la fonction FE_2 signifiera « Retour à la ligne » (NL). Ceci exige un accord entre l'émetteur des données et leur destinataire.
L'emploi de cette fonction « NL » n'est pas autorisé en régime international sur les réseaux généraux de télécommunication (Réseau Télex et Réseau Téléphonique).

② S'il est nécessaire de représenter chacun des nombres 10 et 11 par un caractère unique (par exemple, pour les subdivisions de la Livre Sterling), ils devront prendre respectivement les places de « deux points » (:) et de « point virgule » (;). Ces substitutions exigent un accord entre l'émetteur des données et leur destinataire.
Sur les réseaux généraux de télécommunication, seuls les caractères « deux points » et « point virgule » sont autorisés en régime international.

③ « Réservé pour usage national ». Ces positions sont prévues principalement pour des extensions alphabétiques. Si elles ne sont pas requises pour de telles extensions, on peut les utiliser pour des symboles et un choix recommandé est indiqué entre parenthèses dans certains cas. Des restrictions limitent l'emploi de ces caractères sur les réseaux généraux de télécommunication en régime international.

④ La représentation graphique et la signification des deux symboles monétaires CS_1 (position 2/4) et CS_2 (position 5/12) peuvent varier en fonction des usages nationaux.
L'utilisation de ces symboles pour les échanges internationaux d'information fera l'objet de recommandations ultérieures.

⑥ Le signe « numéro » (#), à la position 2/3, peut avoir une seconde représentation graphique (N°).

⑦ La représentation du « tilde » (~) par l'« accent circonflexe » (^) est admissible pour les échanges internationaux d'information en espagnol et en portugais.

⑧ Les symboles graphiques qui figurent aux positions 2/2, 2/7, 5/14 signifient respectivement « guillemet », « apostrophe » et « flèche en haut »; cependant, ces caractères prennent la signification des signes diacritiques « tréma », « accent aigu » et « accent circonflexe » lorsqu'ils viennent à la suite d'un caractère « Retour arrière ».

NOTES ABOUT THE 7 BIT SET TABLE

① The controls CR and LF are intended for printer equipment which requires separate combinations to return the carriage and to feed a line.
For equipment which uses a single control for combined carriage return and line feed operation, the function FE_2 will have the meaning of « New Line » (NL). This requires agreement between the sender and the recipient of the data.
The use of this function « NL » is not allowed for international transmission on general telecommunication networks (Telex and Telephone networks).

② If 10 and 11 as single characters are needed (for example, for Sterling currency subdivision), they should take the place of « colon » (:) and « semi-colon » (;) respectively. These substitutions require agreement between the sender and the recipient of the data.
On the general telecommunication networks, the characters « colon » and « semi-colon » are the only ones authorized for international transmission.

③ « Reserved for National Use ». These positions are primarily intended for alphabetic extensions. If they are not required for that purpose, they may be used for symbols and a recommended choice is shown in parentheses in some cases.
Some restrictions are placed on the use of these characters on the general telecommunication networks for international transmission.

④ The graphical representation and the meaning of the two currency signs CS_1 (position 2/4) and CS_2 (position 5/12) may vary according to national use.
The use of these symbols for international interchange shall be the subject of future recommendations.

⑥ The « number sign » (#) in position 2/3 may have an alternate graphical representation (N°).

⑦ It is acceptable to represent « tilde » (~) by « circumflex accent » (^) for international interchange of information in Spanish and Portuguese languages.

⑧ The graphics in positions 2/2, 2/7, 5/14 have respectively the significance of « quotation mark », « apostrophe » and « upwards arrow »; however, these characters take on the significance of « diaeresis », « acute accent » and « circumflex accent » diacritical signs when they follow the « Backspace » character.

Data Processing Group

bema

Business Equipment Manufacturers Association
235 East 42nd Street, New York, N.Y. 10017 — MUrray Hill 7-5969

RECD. H. S. BRIGHT
JUN 23 1965

1965 June 18

TO: Members of DPG Standards Committee
ASA Sectional Committee X3
Subcommittee X3.2, Task Group X3.2.4
Subcommittee X3.4, Task Group X3.4.2

Enclosed for your information is the IBM Final Letter Ballot (X3/23) on Proposed Revised American Standard Code for Information Processing.

Vico E. Henriques

Vico E. Henriques
Director of Standards

VEH:moc
Enclosure

CBI 42/5/13

IBM International Business Machines Corporation

Armonk, New York 10504

Office of the Group Director of Standards

June 9, 1965

Mr. Vico Henriques
Director of Standards
BEMA
235 East 42nd Street
New York, New York

Dear Mr. Henriques:

Final Letter Ballot (X3/23) on Proposed Revised American Standard Code for Information Interchange

We have reviewed the Proposed Revised ASCII and are returning our completed ballot together with comments which are in response to the "publication" of the Proposal.

There is no doubt that the revision manifests many significant improvements. For this reason, and because we do not wish to delay the acceptance and processing by ASA, our ballot is marked "Affirmative - with comments."

As is the case with any dynamic subject, such as a code which crosses the boundaries of many interested areas, there will always be suggested improvements and changes. In fact, as a result of the "publication" period we now see three significant changes which we ask you to bring to the immediate attention of the appropriate subcommittees along with the other expected comments.

We reviewed the proposal particularly in the light of programming compatibility and recent developments in programming languages. In our opinion, our proposed changes will significantly enhance the ultimate application and acceptability of ASCII for both programming language and data interchange.

The effect of the three changes is illustrated in the attached.

In essence, we bring the following observations to your attention:

1) For Programming Language Interchange

We foresee that the Logical OR and Logical NEGATION functions of programming both require unique symbols for possible future domestic and international standard programming languages.

Therefore, ASCII will be enhanced significantly by placing these symbols outside of the ISO-designated "national use area" of the code.

2) For Data Processing

We are convinced that the @ symbol is widely used today in data processing and foresee its continuance. It therefore makes sense, in our opinion, to enhance ASCII by locating this character in the center four columns of the code ("64 subset") because this subset will be most naturally and economically implemented in monocase applications.

If these changes are feasible to X3.2 and X3.4, they could have a bearing on the United States comments pertaining to the ISO 7-Bit Code. Because we believe it is essential to strive for maximum consistency between ASCII and the 7-Bit Code of ISO, ECMA, and CCITT, there will also undoubtedly be subsequent revisions internationally as a matter of maintenance.

We believe the USA should show its strong support for the ISO Fourth Draft Proposal and should vote "Yes", but should also include these suggestions along with the other comments for international consideration.

These suggested improvements are offered in the spirit that they will assist in achieving a code that includes the latest requirements needed for maximum long range benefits in data processing and data communication. This would be accomplished through broader acceptance by the programming community and also by having ASCII more consistent with the international 7-Bit Code philosophy for handling national use characters.

Very truly yours,

W. E. Andrus, Jr.
Group Director of Standards

WEA, Jr./sl
Attachment

Information copies to:
DPG Standards Committee
ASA Sectional Committee X3
Subcommittee X3.2
Subcommittee X3.4

ATTACHMENT

June 8, 1965

COMMENTS
(Code Chart Attached)

1) Vertical Line | used as "Logical OR"

We believe that Logical OR is required as a unique symbol for possible future international standard programming languages, for example, PL-I. Therefore, ASCII will be enhanced significantly by placing this symbol (Vertical Line - Logical OR) outside the ISO - designated "national use area."

It is suggested that this can be accomplished most conveniently by exchanging with the exclamation point which can be placed in the national use area. The attachment illustrates this. .

2) Tilde ~ used as "Logical NEGATION"

Here also we foresee that Logical NEGATION is required as a unique symbol for possible future international standard programming languages. ASCII will be enhanced for programming language interchange by placing the logical negation symbol outside of the national use area.

This can be accomplished by allowing the Tilde, which is already an agreed upon ISO alternative to the circumflex to be used as Logical NEGATION in addition to its presently designated diacritical use.

It is suggested that a simple NOTE be added: "Tilde ~ may be coded in position 5/14 and may be used as logical negation in the interchange of programming languages."

Another aspect of this change is that since tilde ~ is used for logical negation, there is no need for the ¬ symbol. This space can be left open for future use or a recommendation can be made now by X3.2.

3) Commercial AT used in Monocase Applications

We are convinced that the @ symbol is widely used in data processing today and we foresee its continuance.

Input/Output equipment and data preparation equipment limited to handling 64 characters in monocase, will naturally and most economically implement the center four columns of the code ("64 subset").

We therefore suggest the commercial AT be moved to this position of the code, which would still be in a national use area.

This can be accomplished by interchanging Commercial AT with the "CS_2 position" of the ISO Code. The ¢ would be inserted in ASCII and would correspond to the ISO CS_2 position for international accord.

This is shown in the chart attached.

ATTACHMENT 2

June 8, 1965

ASCII

CHART ONE

Proposed Revised ASCII as Published

b7 b6 b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	Column → Row ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	`	P	@	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SS	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	~	l	¬
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	|
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

CHART TWO

Proposed Revised ASCII Indicating Suggested Changes

b7 b6 b5 →					0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
b4 ↓	b3 ↓	b2 ↓	b1 ↓	Column → Row ↓	0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	`	P	@	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SS	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
1	1	0	0	12	FF	FS	,	<	L	@	l	
1	1	0	1	13	CR	GS	-	=	M	]	m	}
1	1	1	0	14	SO	RS	.	>	N	^	n	|
1	1	1	1	15	SI	US	/	?	O	_	o	DEL

OPEN for future use or suggestion by X3.2

NOTE: Tilde ~ may be coded in position 5/14 and may be used for logical negation in the interchange of programming languages.

X3/23
1965 March 10

DPG Standards Committee
and
ASA Sectional Committee X3
Computers and Information Processing

LETTER BALLOT ON PROPOSED REVISED AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE

RESOLVED that

X3 approve the proposed Revised American Standard Code for Information Interchange for transmittal, upon completion of the Publication Period, to the Sponsor, requesting that the proposal be forwarded to ASA with a recommendation that ASA accept and publish it as an American Standard.

AFFIRMATIVE [✓ AFFIRMATIVE "WITH COMMENTS"]

Name

Organization IBM Corporation

Date June 9, 1965

If you find that you cannot vote in the affirmative and desire to be recorded as not voting or in the negative, please so state and explain the reasons for your position.

Please execute and return this ballot promptly to:

Mr. Vico E. Henriques
BEMA/DPG
235 East 42 Street
New York, N.Y. 10017

157

X3.2/255

July 1, 1965

TO: ASA SUBCOMMITTEE X3.2

FROM: ASA TASK GROUP X3.2.4

SUBJECT: Comments Received on ASCII Publication of prASCII, and X3 Ballot on prASCII

Task Group X3.2.4 has received four documents commenting on the subject standards. Two were comments on the present ASCII submitted by users, one a comment elicited by the publication of the proposed revision, and one associated with an affirmative vote on the X3 letter ballot on the revision. These have been reviewed by X3.2.4 and appropriate responses made in each case, as follows:

Item 1: Comments associated with the IBM affirmative vote on X3 letter ballot

IBM proposed that the vertical rule (which they propose to use to indicate logical OR) and tilde (which they propose to use as logical NEGATION) be assigned to areas which are not "national use" in the ISO Code.

They also propose that the "commercial at" (@) be relocated in the central four columns of the code due to its "commercial significance" and the expected wide use of 64-character graphic devices.

A specific rearrangement was submitted, founded upon a relocation of tilde to the position favored by ISO but which has not received CCITT acceptance. (We had anticipated that the CCITT view would prevail, and have to date embraced it in prASCII. The suggested arrangement also interchanged vertical rule with exclamation point.

The Task Group consensus, explained to the IBM representatives, was that relocation of the exclamation point seemed unwarranted. With respect to the relocation of tilde, upon which the other IBM suggestions were contingent, the Group passed the following resolution:

> "Task Group X3.2.4 recognizes the merit in the IBM comment which attempts to resolve the difference between proposed Revised ASCII and the ISO 4th Draft Proposal, 7 Bit Code, in the area of Tilde and Circumflex, but feels that no action can be taken at this time in the absence of resolution of the similar difference between the CCITT and ISO Codes."

No changes are thus proposed pursuant to the IBM suggestions.

CBI 67/3/8

Item 2: Letter from Mr. George E. Morgan, Jr., Bethesda, Maryland, offering suggestion for the restructure of prASCII, as published.

Mr. Morgan made an extensive exposition of his own criteria for the formulation of code arrangements, particularly with respect to provisions for international or multi-lingual use. While his proposals were for the most part logical, they represented concepts which largely had been considered and rejected due to their incompatibility with other more compelling criteria.

A letter to Mr. Morgan is being prepared, analyzing these considerations at length and pointing out why we have not adopted the concepts he offers.

Item 3: Letter from Mr. David A. Kemper, System Development Corp., Santa Monica, California.

Mr. Kemper tells of anomalous experiences encountered in the use of ASCII teletypewriters as remote computer terminals. He suggests that a reassignment of the character EOT would mitigate the subject class of problems.

A letter has been dispatched to Mr. Kemper pointing out why we do not propose to make such a reassignment. It treats at length numerous reasons, largely of the following categories:

1. It is impossible to mitigate all communications hazards with a single code structure.

2. Protection against certain hazards should be derived from safeguards in system design and operational discipline appropriate to the system and the source(s) of the hazards.

Mr. Kemper has indicated that he understands our position.

Item 4: Letter and attached memoranda from Mr. William S. Crosby, Boulder, Colorado.

Mr. Crosby describes a number of interesting conventions he has contrived to facilitate the interoperation of ASCII-oriented and non-ASCII-oriented data handling equipment in an automated bibliography processing system at the University of Colorado. Means of extending the use of ASCII to foreign languages not directly provided for were also described.

Mr. Crosby also proposed that the conventional representation of the ASCII code table be made one which facilitates the octal expression of a character. Renumbering of the bits as b_0 through b_7 was also suggested.

Mr. Crosby was an observer at the June 29-30 X3.2.4 meetings. The Task Group expressed the opinion that a change in conventional representation at this time would be impractical, especially due to the widespread use of column/row nomenclature. The ASCII-octal conversion table was, however, hailed as a useful tool for those applying ASCII to an octal-oriented system.

The Task Group feels that the above actions have appropriately dealt with the four sets of comments, and that no further action is required.